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The AUTOMOBILE

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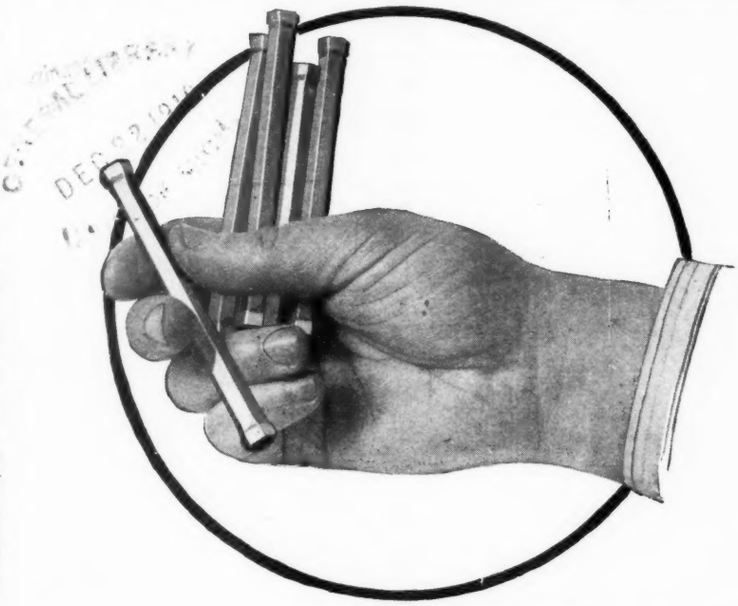

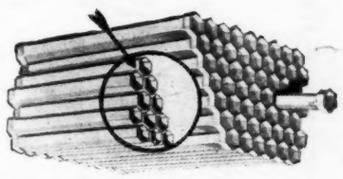

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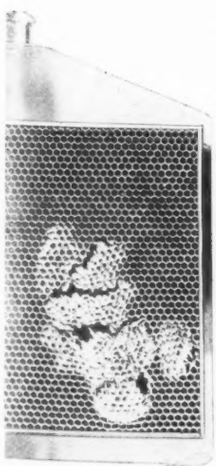

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Ten American and Six Foreign Cars At Salon

First exhibition of the Dupont, apparently designed to meet competition with distinctive foreign cars which have been popular in America. Four cylinder engine of company's own design features clean appearing chassis. Renault's show car already described in Paris Show Correspondence. Singer car again appears

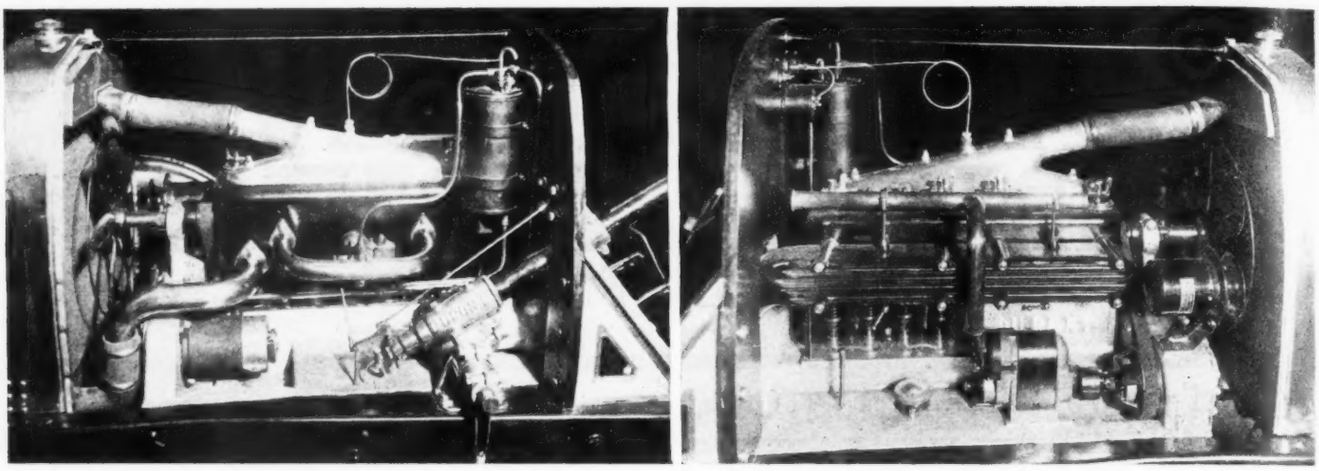
TEN makes of American cars to six of foreign construction are being exhibited at the Automobile Salon in the Grand Ballroom of the Hotel Commodore. Only one of the models exhibited, the Dupont, is strictly new, for although the Renault cars are after-war models, they have been described in our report of the Paris Show. As in former years, the Salon is largely a show of coach work, and six well known manufacturers of custom built bodies are showing their productions. There is also a moderate number of exhibits by accessory manufacturers, including manufacturers of tires, wheels, warning signals, shock absorbers and indicating instruments.

The Dupont is a very clean looking chassis, with a 4-cylinder engine of the company's own design. The engine is of the "L" head, block type, with cylinder dimensions of $3\frac{15}{16} \times 5\frac{1}{8}$ in. Thermosyphon circulation of the cooling water is used. A Stromberg carburetor is fitted, and a Simms magneto. Lubrication is by force feed to the main and crankpin bearings, and by spray to the cylinder walls and the minor bearings. The gear type oil pump is located on the cover of the distribution gear housing and is readily accessible. It is driven from the forward end of the camshaft.

Hot air for the carburetor is drawn from behind the exhaust manifold, and is drawn through a passage cast in the cylinder block between the second and third cylinders. The inlet passages from the carburetor to the inlet valves extend between the first and second and between the third and fourth cylinders respectively. A thermometer is inserted in the water return manifold on top of the engine, and connects to an indicating instrument on the dash board, from which the instantaneous temperature of the water leaving the cylinder jackets can at all times be read off.

The oil strainer, located in the bottom of the crankcase, can be readily removed through an opening in the side wall of the case. The Westinghouse electrical equipment, comprising a separate generator and starter is fitted.

The power plant is of unit construction, comprising a single disk clutch and a four speed and reverse change gear manufactured by Brown-Lipe. The third speed is the direct drive, and the fourth speed as an over-geared



The Dupont, a creation of the Wilmington works. Both sides are shown

speed. The reduction between the engine crankshaft and rear axle on the direct drive is 4 3/11 to 1, while the reduction on the overgeared fourth is 3½ to 1. Spicer universals and Columbia axles are used, and the car has a wheelbase of 124 in. Twenty gallons of gasoline are carried in a tank at the rear, and is fed to the carburetor by the vacuum system. The rear axle is of the full floating type, and Hotchkiss drive is employed.

A feature of interest is found in connection with the rear springs which, at the end, instead of being shackled to the spring horns in the usual manner, have a universal joint connection with the spring horn, which relieves both the springs and the frame of any twisting strain.

THE RENAULT

The car has left hand drive and center control, and there is a specially neat feature in connection with the throttle and spark control. Instead of a sector, there is a complete ring on top of the steering wheel, and each of the two levers moves over one-half of this ring. The shafts of the levers at their lower end carry cams which act on single arm levers pivoted to the steering gear housing, and having their free ends connected by links to the parts to be operated. It is the intention to sell the complete car with five passenger touring body and full equipment at $4,000.

The Renault models have already been dealt with in our report of the Paris Show, but a few observations on their design, from the American standpoint, will not be amiss.

These Renaults are equipped with generator and starters of French make, and the design of this electrical equipment, as well as the location of the unit, is out of the ordinary. Owing to the fact that Renault uses a centrifugal fan, the blades of which are mounted on the rim of the fly wheel, it would not be possible to use a flywheel starter drive, and so both the generator and starter in the 6-cylinder model are mounted at the forward end of the engine. On the smaller Renault model a single unit electrical equipment is used, which is also mounted on the forward end.

The comparative inexperience of foreign manufacturers in the design of electrical equipment and its mounting is apparent on several of the models. One of the problems that gave our own manufacturers considerable trouble also is that of battery mounting. On one of the French cars the battery is mounted in a candle hung from a single frame cross member, and it would seem that inertia forces on the battery in case of sudden acceleration or deceleration of the car would place the support under great strain. Among features that impress one favorably on the Renault models are the long pedals and the substantial gear and brake levers.

A feature which is very characteristic of the leading French designs of chassis is the form of the machinery cases, which might be described as plastic. Where several cases are bolted together, there are never any abrupt changes in section, but one case merges into the other gradually and smoothly. The majority of French automobile factories are located in the suburbs of Paris, and it may be the familiarity of their designers with sculptural work in the Paris museums and parks which leads them to give an artistic touch to the outline of their power plant and other important parts. Units designed along this line are certainly of pleasing appearance, though it is not obvious that the plan has any effect on the operating characteristics of the machine.

THE DELAGE

On the Delage stand a number of engine parts were shown separately, including the crankshaft, piston and connecting rod. The crankshaft is of the four bearing type, and is completely balanced, some of the crank-arms being in the form of nearly complete disks. It was not plain whether the crankshaft was turned out of a solid billet or whether it was built up by welding.

Both the pistons and the connecting rods are made from steel forgings, and emphasis is laid on the great amount of material removed from the forgings in machining. Thus it is stated that the connecting rod, which is of I section, is reduced from a weight of 1.74 kg. to 0.7 kg. and the piston is reduced from 3.7 kg. to 0.5 kg. The piston especially seems to call for an enormous amount of machine work as compared with the ordinary design.

It is very noticeable that all of the foreign cars are built very low, there being a big drop in the front axle

and a "kick-up" in the frame over the rear axle.

One of the American exhibitors is the Singer Motor Co., Inc., which has recently been reorganized. Originally this company built 6-cylinder cars, but the model exhibited is a 12-cylinder with a 2⅞ x 5 in. built by Weidely. The outstanding feature of this car is the very heavy frame, the side members having a depth of 8½ in., and a width of flange of approximately 3½ in. With this type of frame it is claimed to be impossible to get any body weave or door rattle.

This car is to be built in 4, 6 and 7 passenger open jobs and 4 types of closed jobs. The company builds its own bodies, and has just completed plans for combining its body and chassis assembling establishments under one roof. In the 7 passenger touring car the weight of the car, ready for the road, is equally distributed between the four wheels, which is claimed to favorably affect the steadiness of the car on the road, and the tire wear.

Among the accessories shown is the Michelin disk wheel, the American rights for which have been secured by the Budd Wheel Corporation. Wheels of this type are shown both in the stand of A. Faure who exhibits a French tire and on that of the Daniels Motor Car Co., fitted to a Daniels 8. While the Michelin disk wheels manufactured in France are all provided with clinch rims, in this country the wheels will be made with straight side detachable rims. The single steel disk is flanged to form a drum of great strength, reinforcing the rim at every point. The demountable wheel is locked to the hub by 4 or 6 self locking nuts. The locking studs pass through flanged holes in the disk, and the flanges are of such shape that they do not bear up against the radial flange on the hub, to which the disk is bolted, thus giving a spring washer effect. These wheels are of the demountable type.

The cars at the Salon were Cunningham, Daniels, Delage, Dupont, Lancia, Locomobile, Meteor, Singer, Porter, Renault, Revere, Rolls-Royce and Sunbeam. Body builders exhibiting were Barker, London; Brewster, Brooks-Ostruk, Fleetwood and Rubay. Equipment dealers showing were Dunlop, Faure, S. Smith & Sons, the Laidlaw Co., Westinghouse, Klaxon and Reese.

The British Show at London

General view of the ground floor exhibits in the main hall at Olympia. Accessories were staged in the galleries, body builders and tire makers in the annex. Photo shows less than half the total area of the main hall.

Recent Ignition Practice in Great Britain

Last week Mr. Hutton told us how the British makers had adapted the American starting and lighting systems. This week he is discussing the ignition problems they have mastered through the war experience and he tells an interesting story of the development of a great industry under the spur of national necessity

By F. H. Hutton

THE phenomenal growth of the British magneto industry during the strenuous days of war constitutes one of the brightest pages in industrial history. A few of the main facts may be recalled. On the outbreak of war one firm only was actually producing magnetos in England, and that on a very small scale; it had a very uphill task to contend against the deeply rooted notion of the motoring community that the only good magnetos came from Germany. The output in those days was about 100 per month, an almost negligible amount. In spite of warnings, the British Government showed its usual apathy in such matters and did nothing whatever to assist the progress of this vital key industry.

War was declared; the Government suddenly woke up to the fact that the internal combustion engine was going to play a "star" part in the performance, and began to call loudly for magnetos, not only for cars but the much more complicated designs necessary for aeroplanes. Under these circumstances the British magneto industry came into being.

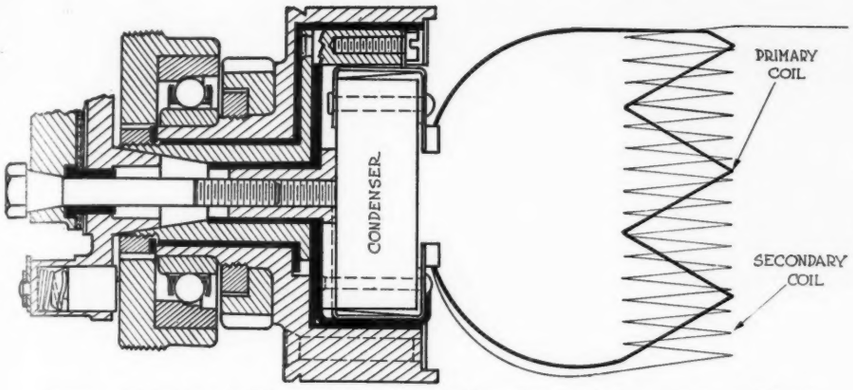
At the outset difficulties, apparently almost insuperable, presented themselves in rapid succession. None of the component parts was to be obtained in the country. Permanent magnets, the insulating material used for the moulded parts—such as the distributer—insulating paper, silk, and varnish, all these essential materials were lacking, the manufacture of them having been centered in Germany. Even the fine enamelled copper wire, of which such a large quantity is necessary, could not be obtained in the quality required.

Most of the firms who took up the manufacture of magnetos combined to form the British Ignition Apparatus Association, and it is due to the co-operation and mutual goodwill shown by the members that the industry has produced such wonderful results. Free intercourse and exchange of views have taken place all the time, so that each firm has had the benefit of any investigation or research work carried out by any other firm. This is undoubtedly the way to promote true progress, and it is unfortunate that it is the exception rather than the rule in the manufacturing industries of England.

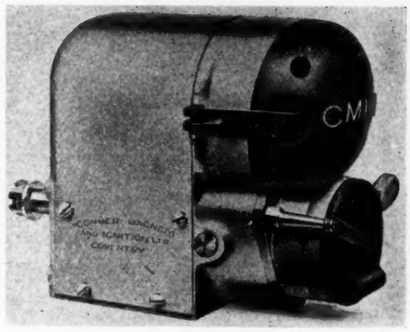
The principal points in which improvement is shown over the German models are as follows: The general appearance and finish of the exterior is more pleasing; corners have been rounded off and an almost "streamline" effect produced, offering no lodging place for dirt to accumulate. By means of felt glands or other devices —in some cases by ground facings—the machines have been rendered practically waterproof. Instead of using solid cast-iron pole pieces for the magnets, the shoes are now generally of laminated construction, a form which has a very marked effect on the performance of the machine; eddy currents are prevented and good sparking is ensured down to a very low speed, considerably under 100 r.p.m.— in some cases is it claimed that satisfactory working is obtained at speeds as low as 50 r.p.m. of the armature.

Another improvement is the "jump spark" type of distributer now generally, though not universally, adopted in place of the carbon brush type. The common trouble of "tracking" is thereby avoided and the spark at the plug is also augmented, for the addition of the extra spark gap thus placed in the circuit insulates the high-tension circuit until the pressure has risen to a figure at which it is capable of overcoming this extra resistance; it then rushes round the whole circuit with increased energy and is less liable to be affected by a minor defect in the plug.

The safety spark gap is now often combined with the revolving distributer point and situated within the same casing; the latter being ventilated, the products of ionization are allowed to escape, instead of finding their way into the interior of the machine where they might do harm. The weight of the magneto has been



Conner magneto winding, showing how both ends of primary are brought out.



The magneto and driving end of the Conner magneto is completely encased in a one-piece aluminum cover.

considerably reduced, an average machine for a medium size four-cylinder engine now weighing only about nine pounds.

There has been a very marked improvement in the contact-breaker mechanism. In high-speed machines, and especially on some airplane types, it was found that the contact-breaker arm was subject to such violent motion that it had not time to make proper contact between the sparking periods, and a "bouncing" or "flinging" action occurred instead of a regular opening and closing of the points. In extreme cases the rocker-arm has been known to break. To overcome this and other defects several modifications have been made in the design. The cams, which in the pre-war machines consisted of separate pieces of steel attached to the inner side of the cam ring, have, in most cases, been abandoned in favor of a method whereby the cams and cam ring are formed out of one solid ring of steel, the necessary curve on the inner side being produced by profile grinding machines. The shape of the curve so produced is such as to give a smooth harmonic motion to the arm without any of the flinging action previously referred to.

The rocker-arms have been made lighter, generally by means of using steel pressings in place of solid machined forgings. In other cases the forged construction has been retained, but has been re-designed and balanced so that the action of centrifugal force does not affect the pressure on the contact points.

In nearly all cases some provision has been made to avoid the danger of the contact arm sticking, owing to swelling of the fibre bush in damp weather, material being employed for the purpose which in some cases is guaranteed not to swell, even if soaked in water indefinitely.

One of the parts most liable to break down in pre-war magnets was the condenser, and this has been greatly improved in its mechanical construction and is in consequence more reliable.

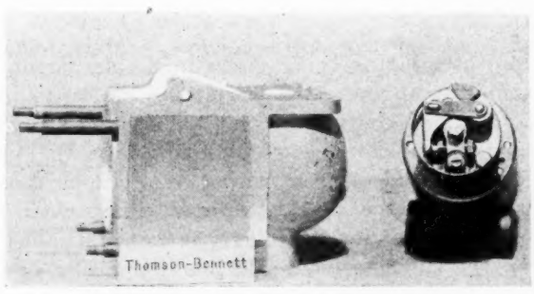
Lubrication of the bearings has been attended to, chiefly with the view of avoiding the overdose of thick engine oil which is often administered by the user. In some machines the bearings are filled with gasoline during erection, and this filling is calculated to last for several years' normal use before requiring renewal; in other cases an overflow is provided in order to drain away any excessive supply of oil.

In most machines the main body consists of an aluminum alloy die casting, into which are cast in position the base plate, the laminated pole pieces, and the distributer end plate, making a very solid and workmanlike job. One or two magnetos have their distributer casings of aluminum, instead of consisting entirely of moulded insulating material, the idea being to give increased strength.

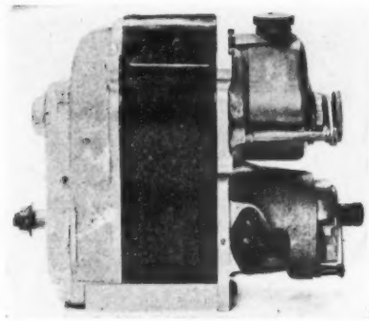
It should also be realized that during the same period the various types of magneto have been standardized by the British Ignition Apparatus Association, working in conjunction with the British Engineering Standards Association, as regards the main overall dimensions; tables have been drawn up showing the dimensions of each type and the designation of the corresponding pre-war continental machine. To the air services alone about 300,000 magnetos were supplied by British manufacturers during the war .

The British Thomson-Houston Co. of Coventry, in addition to their large output of standard type magnetos, have energetically developed the "polar inductor" type. These machines lend themselves especially to airplane work, since, by using a four-arm rotor, four sparks can be delivered per revolution instead of two, which is a great advantage in the case of eight and twelve cylinder engines so common on airplanes, as excessive speeds of the armature are thereby avoided.

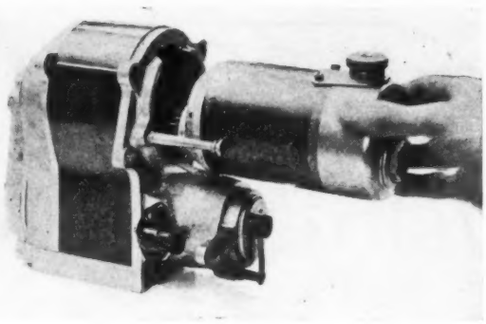
An interesting model is one designed originally for use on the 9-cyl. Dragon-fly engine; it has a four-arm inductor on a straight-through shaft of non-magnetic nickel-steel. A special feature is that the inductors, as well as the magnet pole pieces, are laminated so that the whole path of the magneto field between the magnets



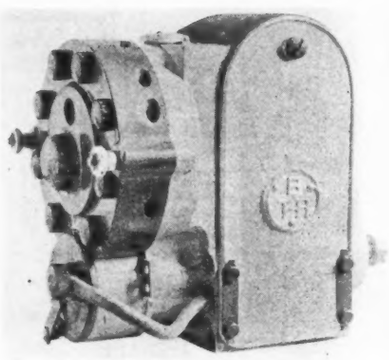
Base casting of Thomson-Bennett magneto with laminated pole shoes cast in.



Lucas Magdyno.



Lucas Magdyno, showing generator removed from its position in the arch of the magnets.



B. T. H. 8-cylinder polar inductor magneto.

themselves is entirely laminated; as a result the magneto works satisfactory at very high speeds, such as 4,000 r.p.m., at which speed 16,000 sparks per minute are generated.

The Conner magneto, a machine made by the Conner Magneto and Ignition Co., near Coventry, an offshoot of a company which has had many years' experience in manufacturing elertrical apparatus, is made in several different types for airplanes and cars. One, known as No. 418, though in the first instance designed as a light car model, has proved to be quite suitable for engines up to 30 h.p., for it has very good low speed sparking characteristics, ensuring an easy start. The end bracket carrying the distributor gear is an integral part of main casting, while the distributer gear-shaft is supported on two rows of widely spaced bearings; no oil holes are provided, as the bearings are packed during erection with grease that will suffice for some years of constant service. The machine has a one-piece sheet aluminum cover, which completely encloses the magnets and driving end; this cover is lined with impregated felt and keeps out all wet and dirt.

In the larger Conner machines, both ends of the primary armature winding are brought out by means of insulated sleeves, and the ground connection is obtained entirely through the brush in the base of the contact-breaker without the necessity of insulating the outer ball races.

Thomson-Bennett magnetos were the only machines manufactured in England when war broke out. In addition to a large range of ordinary type magnetos, the makers are also making a combined magneto and dynamo for use on light four-cylinder cars.

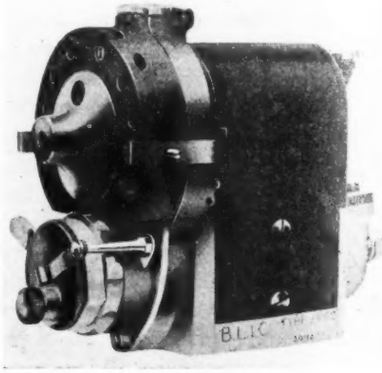
SPARK PLUGS

More attention is being given to the design of spark plugs for car engines, due largely, no doubt, to the experience gained during the war with plugs on airplane engines, although the conditions to which the plug is subject are not identical in each case. The most marked feature is that the plugs are now either made to be easily dismantled for cleaning, or have supplied with them a special instrument enabling the insulation to be scraped clean around the central electrode. The latter method is generally adopted in the case of plugs with single-point electrodes and the detachable system for three-point plugs. The three-point plug is perhaps more generally used on British car engines, but opinion is still very much divided on the respective merits of single and multiple points. Users of British cars have an advantage over those who drive American cars, on account of one plug thread being standard for the former compared with the three commonly used in America. (There is only one standard spark plug thread for automobile engines in this country and over 90 per cent of the manufacturers are using it.—Editor.)

On the outbreak of war the conditions relating to plug manufacture in England were almost as bad as in the case of magnetos: Only three firms were manufacturing, with a toal monthly output of 420, an output which increased to over 300,000 November 1919.

Typical of the British spark plug industry is the Lodge Sparking Plug Co. of Rugby; this firm, owing the largest plug factory in the Kingdom, produces plugs for all classes of engine, British and American, motorcycle, two-stroke, and airplane. But the main effort of the Company is concentrated on a standard model known as C3, a three-point, demountable plug which is being manufactured on a quantity basis in order to sell it at five shillings. It is offered with either short or long barrel, and, in length of reach from ¾ in. to 2 in. For the insulation both mica and steatite are used; mica for the internal insulation where it is exposed to great heat, and steatite for the outside, which is exposed to oil and dirt.

A mica plug which has come into great prominence during the war is the K.L.G. It is a one-piece non-detachable plug with mica insulation throughout and is

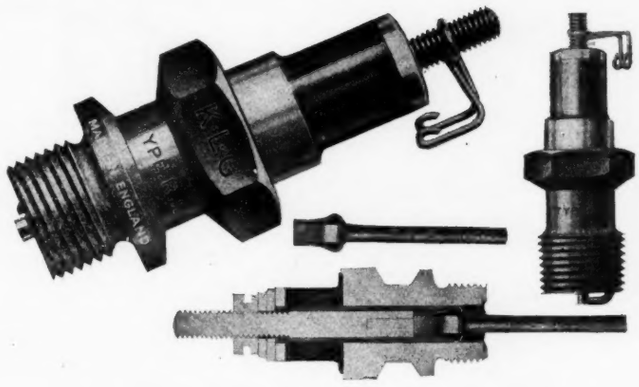


B. L. I. C. magneto made by the British Lighting and Ignition Co., a subsidiary of the Vickers firm. This concern has secured rights under the British Bosch patents from the Board of Trade and taken the Bosch plant in London.

supplied with a special scraper for cleaning purposes, the standard model having a single point. A special feature is a self-locking terminal clip in place of a nut.

BATTERY IGNITION

It is an undoubted fact that battery ignition is now attracting much attention in England and on the Continent of Europe. The British ignition apparatus manufacturers, during and since the war, have had such a busy time developing the magneto and fulfilling the enormous quantity of orders for it, that they have not been able so far to put battery ignition sets on the market, although some of them are seriously experimenting with this form of ignition. The American Remy and Delco systems have been adopted by the makers of some of the highest grade British cars as a supplementary ignition. A feature of the Remy policy is the excellence of the wiring diagrams, both pictorial and technical, which are supplied, together with the special instruction book, for each make of car to which the system is applied.



K. L. G. spark plug in section, showing cleaner in use. Note peculiar spring wire self-locking device for high tension cable terminal.

An Airplane Stress Meter

CERTAIN parts of an airplane are subjected not only to the stresses imposed by the aero-dynamic or flying load, but also to the initial stresses, caused by the tension in the stay and drift wires. An appreciable initial stress in these wires is necessary to maintain the alignment of the machine. In many cases the initial stresses have been found to form too large a proportion of the total load. Failure of the structure in service has resulted from an improper adjustment of the turnbuckles in the stay and drift wires and cables.

It has been customary to depend upon the judgment of the mechanics assembling an airplane for securing the correct initial tension through adjustment of the turnbuckles. They secured what they considered the proper uniform tension by the "feel" of the wire or by listening to its vibrant sound when plucked with the finger. Either of these methods is obviously crude and inaccurate, owing, among other things, to the widely varying diameter and length of the wires. Some experiments have shown that wires thus adjusted for equal tension have really varied by several hundred per cent. A dangerous condition may thus be developed by causing overloading of airplane members through adjustment of initial tension. This emphasizes the need of an apparatus to determine accurately the load in a flexible tensile member.

L. J. Larson has invented an instrument known as the tensiometer which is simple in construction, accurate and easily and quickly operated.

The instrument consists, essentially, of a frame with supports spaced 10 inches apart, between which a section of the wire or cable is adjusted. Midway between these supports, and operated by hand grips, is a plunger which deflects the wire 0.1 inch from its normal position. The operation of deflecting the wire compresses a calibrated spring. A dial indicator measures the deformation of the spring and thus the load on the wire. One revolution of the indicator pointer corresponds to a load of 1,000 pounds, and the smallest dial division, to a 10-pound load.

The Tensiometer is made direct reading by graduating the indicator dial upon the loading spring so as to read tension in the wire instead of load upon the spring. A second dial indicator allows the simultaneous determination of the deflection to the nearest 0.001 inch. The use of these two sensitive indicators for accurately determining the position and load upon the wire is, in a great measure, the reason why accurate results are obtained with the Tensiometer.

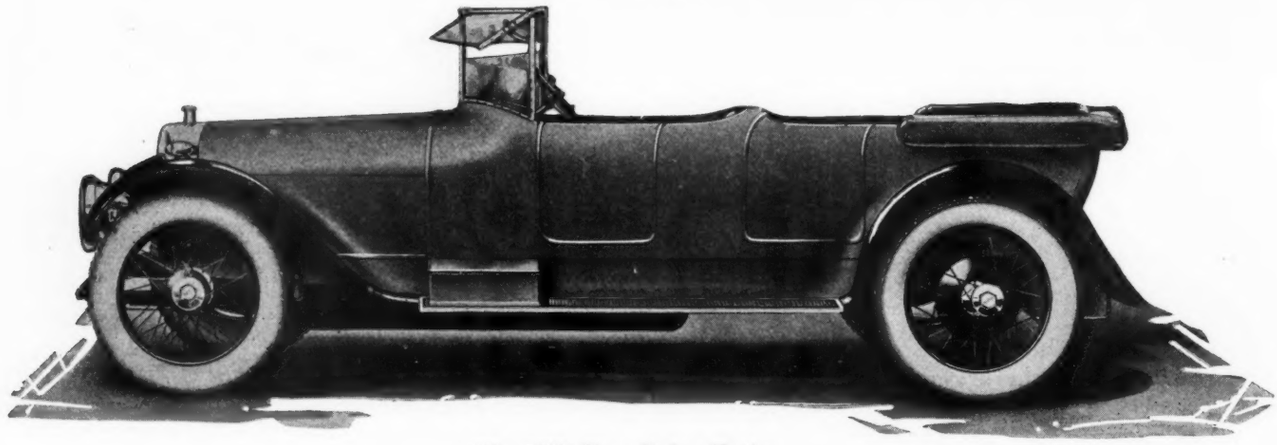
The theory upon which the instrument is based is very simple. If a wire, under tensile stress, is supported at two points and loaded at the middle of the span thus formed, a system of three forces in equilibrium is established. If the span and deflection are kept constant, as in this instrument, the deflecting force is a constant fraction of the tension in the wire.

In use it is never desirable to attach the Tensiometer to the wire. It is simply put into place and the grips are brought together until the proper deflection is obtained. The tension in the wire is then read from the other dial, which gives the value directly in pounds of stress.

An illustrated description of the device with a discussion of its theory is contained in Report No. 32 of the National Advisory Committee for Aeronautics.

THE National City Bank of New York states that exports to South America in 1919 will exceed those of any earlier year by more than $100,000,000. Published reports to the effect that South American buyers of merchandise from the United States were canceling orders seem to have been greatly exaggerated, according to official reports of export trade to that continent.

DR. ROYAL MEEKER, Chief of the Bureau of Labor Statistics, in a recent "Health and Decency Budget," gives $2,262.47 as the minimum salary necessary to cover the living expenses of a Government clerk with a family of four.



The 1920 Six-cylinder Napier

Aircraft Practice in the 1920 Napier

There has been much discussion of the adaptation of aircraft practice to the automobile but it has been slow in appearing. This new Napier model, which will take its place as the most expensive British car, makes the first extensive showing of aircraft lessons. The car bears no resemblance to the pre-war model and the engine closely follows the one made by this firm during the war for air service. There is quite a liberal use of aluminum

By M. W. Bourdon

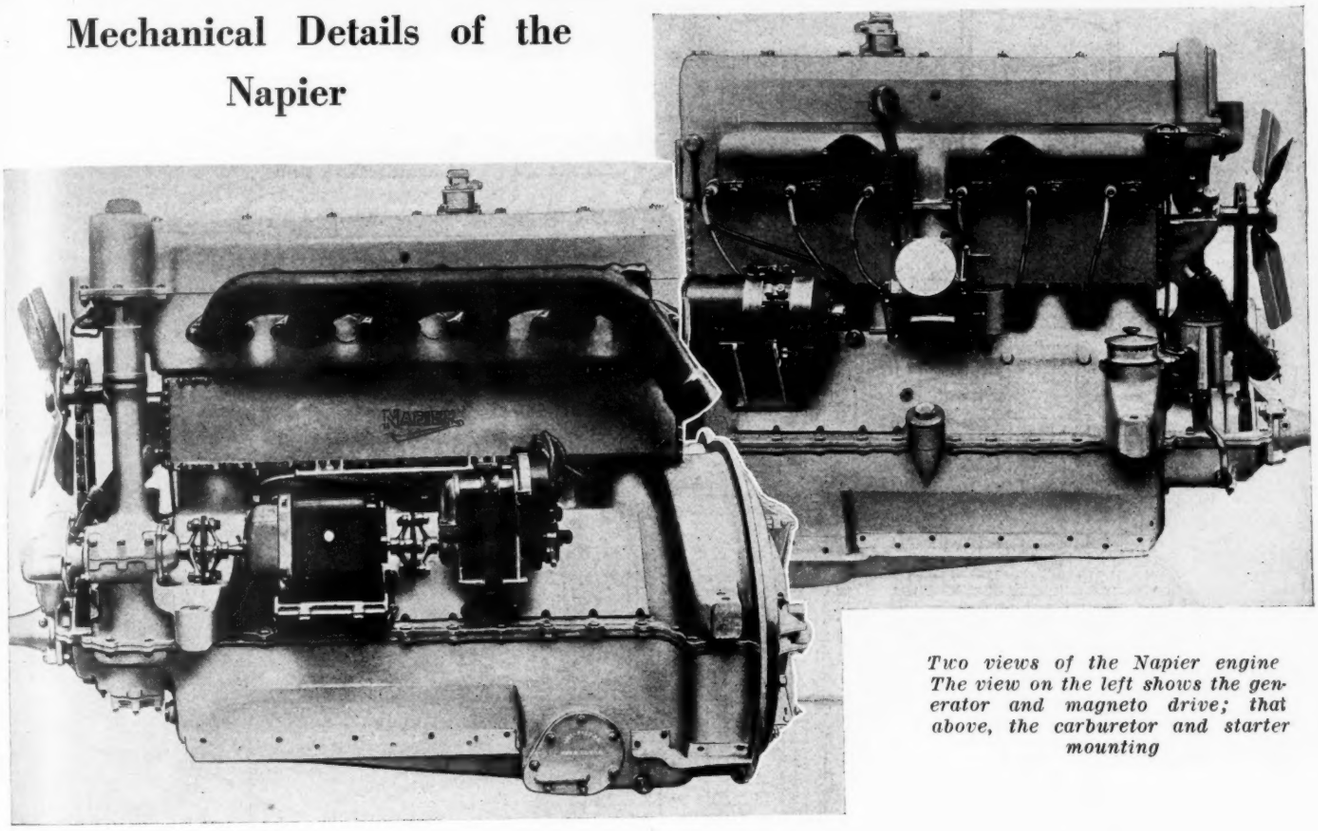
IN line with several French manufacturers, the British firm of D. Napier & Son, Ltd., have entered into direct competition with Rolls Royce, and their 1920 model six-cylinder chassis, the only type that will be made next year, is priced at a higher figure than any chassis yet announced to be made in the British Isles. The chassis is offered with a three years' guarantee at £1750 (approximately $7500).

The new Napier chassis bears practically no resemblance to the pre-war model, and the 4 x 5 in. engine has embodied in its general arrangement features that have been developed in airplane engine practice. Overhead valves are fitted in the detachable aluminum cylinder head and are operated by an overhead camshaft, acting through rocking levers pivoted on two longitudinal shafts; the cams make contact with rollers arranged midway in the length of the rocking levers, the free ends of which have threaded studs for valve clearance adjustment.

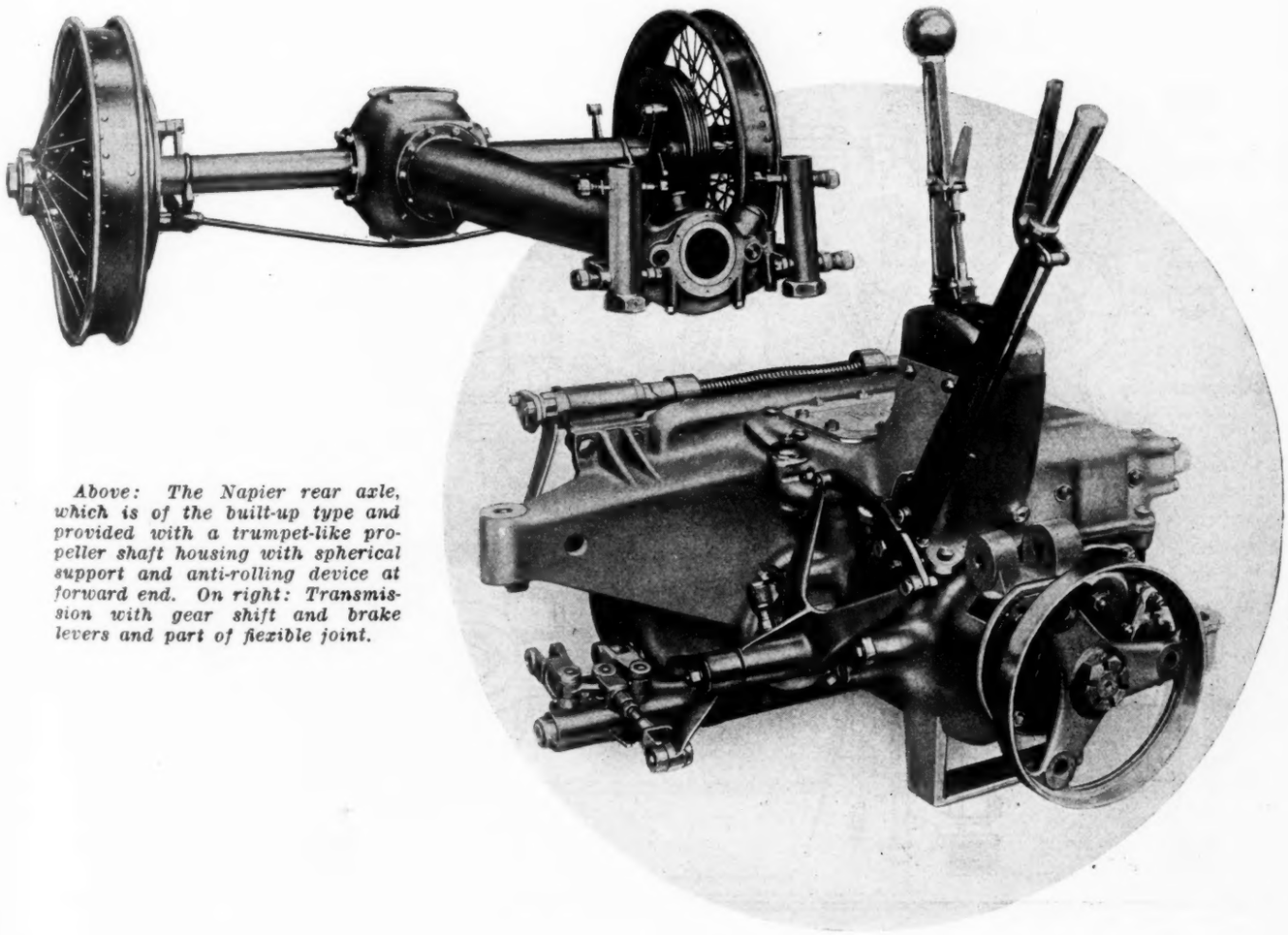
The cylinder jackets and upper half of the crankcase are cast as a unit in aluminum with pressed-in steel liners for the pistons. At each side of the barrels is an aluminum cover plate running from end to end, secured by a large number of studs and nuts, and forming the sides of the water jackets. The valve ports are all arranged in the detachable head, into which are screwed the tungsten steel valve seats and bronze bushes for the spark plugs. Valve guides, also in bronze, are pressed into the head casting.

The overhead camshaft is operated by means of a vertical shaft and worm and helical gearing. All the valve gear is enclosed by an aluminum cover, on the top of which is secured, near the rear end, the pump which supplies air to the pressure fuel tank; this pump is actuated by a special cam on the camshaft. The inlet manifold is cast with, but protrudes from, the head, the carbureter being bolted to a flange on a branch depending from the center; the exhaust branch is a separate unit on the left-hand side of the head. The crankshaft is supported by seven white metal bearings

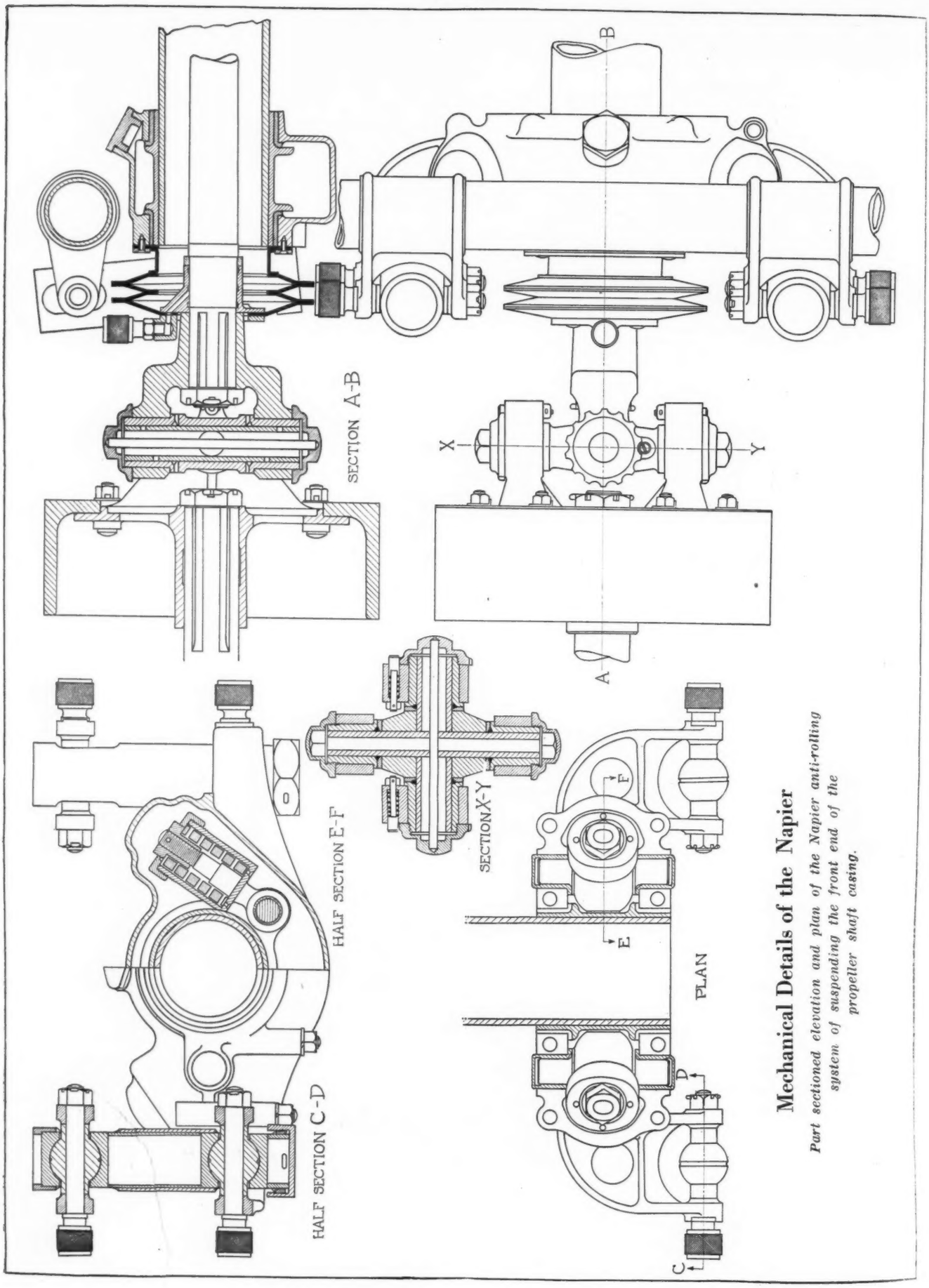
Mechanical Details of the Napier



Two views of the Napier engine The view on the left shows the generator and magneto drive; that above, the carburetor and starter mounting

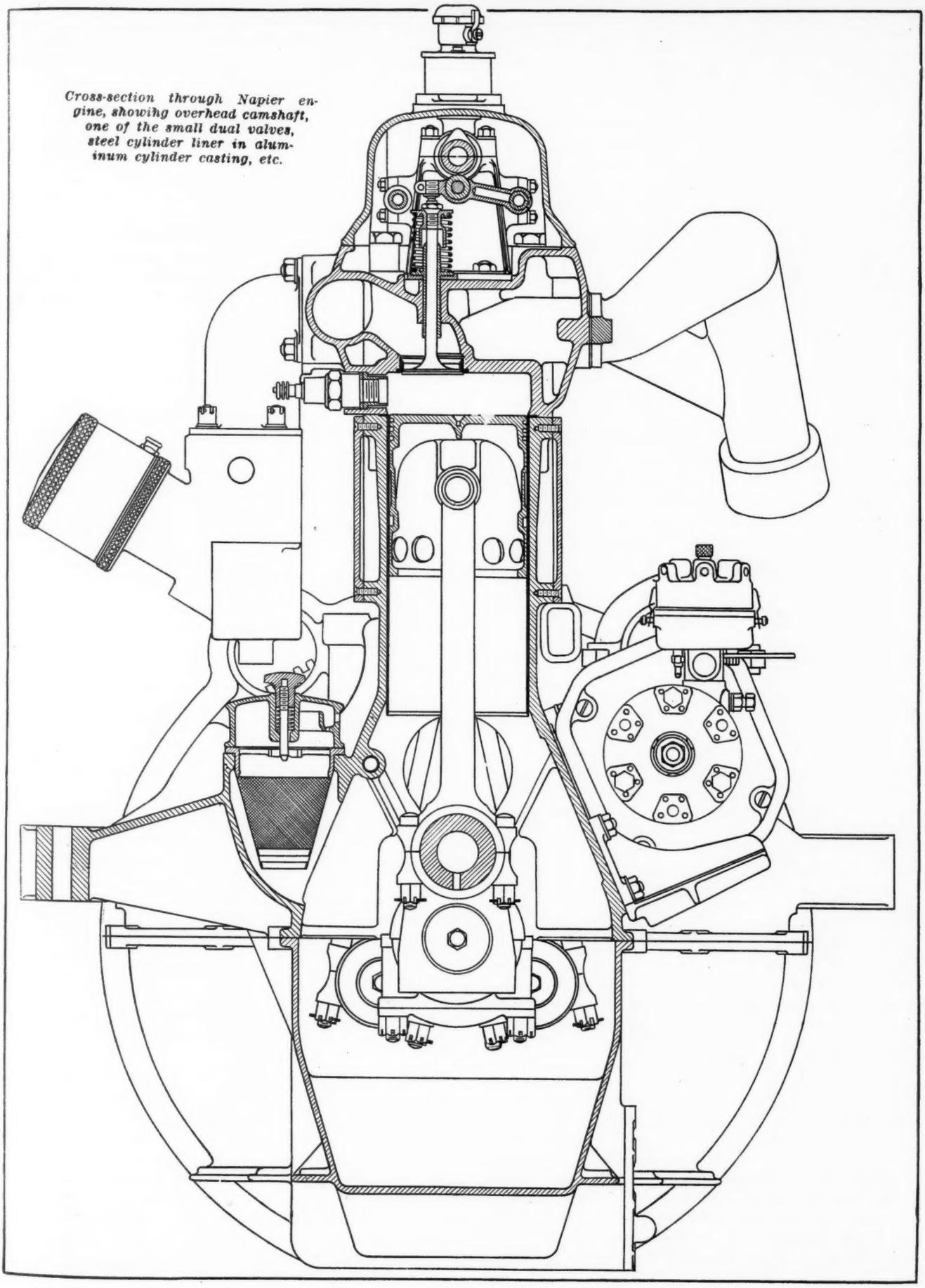


Above: The Napier rear axle, which is of the built-up type and provided with a trumpet-like propeller shaft housing with spherical support and anti-rolling device at forward end. On right: Transmission with gear shift and brake levers and part of flexible joint.



Mechanical Details of the Napier

Part sectioned elevation and plan of the Napier anti-rolling system of suspending the front end of the propeller shaft casing.



Cross-section through Napier engine, showing overhead camshaft, one of the small dual valves, steel cylinder liner in aluminum cylinder casting, etc.

in the upper half of the crankcase, the lower half being a detachable aluminum casting forming the oil sump. Tubular connecting rods are used, with aluminum straight-sided pistons having three compression rings and one scraper; the hollow wrist pin is fixed in the piston bosses by set screws.

The crankshaft is drilled for forced lubrication to the journal bearings and big-ends, a gear type pump, driven by an extension of the vertical shaft operating the camshaft, drawing oil through a filter in the sump and delivering it through another filter to a steel pipe inside the crankcase leading to the main bearings. Lubrication of the valve gear and camshaft is assured by delivering the oil under pressure through a lead to one camshaft bearing housing, and thence through the hollow shaft to the other bearings. The excess of oil thrown off from the latter serves for the cams and tappets, the surplus draining back into the crankcase through the driving shaft casing. To prevent over-lubrication of the cylinders, pressed steel baffle plates are arranged between the crank webs and the bottom of the cylinder bores.

As might be expected with an engine of this type, pump circulation is used for the water, the pump being arranged in front of the distribution casing and driven by a forward extension of the same shaft that serves for the dynamo and magneto in tandem. The two last-named units are arranged alongside the crankcase, with a flexible disk joint between them and another between the dynamo and distribution gear. In addition to magneto ignition, an independent system, obtaining current from the batteries and utilizing a coil and distributer, is provided.

The carbureter is of a modified S. U. type, wherein the suction takes effect upon the upper side of a flat piston in an enclosed cylinder; the lifting of the piston serves to admit air by raising a second piston of smaller diameter, which in its normal position blocks the air inlet passage. A tapered needle valve depending from the air piston projects into the fuel jet and is raised or lowered simultaneously by engine suction. In addition, a supplementary carbureter is used for starting and slow running purposes, this carbureter going out of action as the main carbureter comes into use. The throttle lever over the steering wheel takes effect only upon the throttle of the supplementary carbureter, the usual pedal being provided for the main carbureter throttle. The fuel feed through the main jet is adjustable by means of a lever over the steering wheel, which enables the jet to be lowered or raised relative to the taper needle attached to the floating pistons. Two small pipes lead from the carbureter air intake to the interior of the valve cover, oil-laden air being drawn in this way past the air piston and the inlet valve stems into the combustion chambers, somewhat on the lines of the extra air fitting at one time adopted in connection with the Knight engine on the English Daimler cars.

A single-plate clutch conveys the drive to the gearset through two flexible disk joints and a latticed girder type of coupling. The disk joint against the transmission casing has a metal rim attached to its star piece, this rim serving for a clutch brake. Four forward speeds and a reverse are provided, the gear and brake levers being arranged above the center of the box. The shafts run on roller bearings and from one of the gears a speedometer drive is taken. At the rear end of the driven shaft is the drum of an external shoe type brake, the shoes being contracted by means of cams on a transverse shaft.

Attached to the brake drum is the driving fork of a star type universal joint, the driven fork being mounted on the spliced end of the propeller shaft. The latter is enclosed in a massive torque tube, and in connection therewith is a special feature of the chassis. The front end of the tube can oscillate within white metal bearings in a T-head when one back wheel is raised relative to the other, but to prevent "rolling" and undue side sway at corners, the torque tube end has an eye brazed to it at each side, these eyes being coupled by short, stiff springs to the interior of the hollow T-head. Thus any vertical movement of only one end of the axle in relation to the frame is resisted. The head of the casing is itself anchored to a tubular cross member by ball-ended unsprung links, free to move in any direction except vertically.

The theory underlying this form of propeller shaft casing anchorage is that a spring suspension to be ideal should be separately controlled as to (1) its vertical period and (2) its rolling period. In ordinary forms, the springs are designed to give the most suitable vertical period so as to absorb road shocks to the best advantage, but they are not then individually strong enough to hold the wheels on the road or to resist the tendency of the superstructure to sway or "roll," especially at corners. In the Napier system each of the periods is separately under control, and both the weight-carrying and the roll-resisting springs can be varied at will to give the best results in either respect, without one set affecting the functioning of the other. Although the system has only just been introduced in public, it was fitted to Napier cars built in 1914 and would have appeared on those that were to have been at the Olympia show if the latter had not been adandoned owing to the war. During the intervening period, it has been tested out very thoroughly and found, without doubt, to constitute a great improvement over the older models.

A sliding pot joint occurs between the rear end of the propeller shaft and the final transmission, which consists of helical bevel gearing giving a top gear ratio of 3.75 to 1, the other ratios being: 3rd, 5 to 1; 2nd, 6.75 to 1, and 1st, 12.5 to 1. The rear axle consists of a cast center with two tubular extensions bolted to it and the whole stiffened by a tie-rod. Ball-bearings are used to support the differential casing within the axle, which is of the full floating type and has roller bearings at the ends to carry the wheel hubs. Cantilever springs are used at the back and semi-elliptics at the front, all springs being enclosed in leather grease-retaining gaiters.

The following are some of the leading dimensions: Wheelbase, 137 in.; track, 56 in.; overall length, 15 ft.; dashboard to center of rear axle, 8 ft.; length of frame available for body, 9 ft. 8 in.; ground clearance, normal, 8 in., special (for export), 9½ in.

The power-to-weight ratio of this chassis is high, for while the engine develops 90 bhp. on the test bench, the chassis complete with full equipment, including dynamo lighting and an engine starter, oil, water and all fittings, weighs only 2800 lb.

The Trend of Automobile Body Design

The subject of this article does not do it justice.. It is really a history of body designing and an outline of the factors that must be a limitation of design for years to come. The article is prepared from notes made during the reading of a paper on this subject by George J. Mercer, now with the Saxon Motor Co., and well known as a body designer

By P. M. Heldt

THE functions of the designer in motor body shops are similar to those of the carriage designer and most of the present-day designers received their training in that school. We use the same methods of design fundamentally, but they have been elaborated in proportion to the greater volume of business; in some respects we have greater latitude, as we are not tied down with respect to weight in the same way as the carriage designer was.

At the beginning of the motor car business, the carriage trade was in a fairly prosperous condition, and the designing department was a part of every well established shop. The draftsman was provided with adequate facilities to do his work, such as room, boards, patterns and trade magazines showing the prevailing styles and the fittings, trimmings, etc. In nearly every large city in Europe, and also in New York, there had been established trade schools. In some cases supported entirely by the trade, these schools had day and evening classes where the young men connected with the industry could learn the art of designing at a very nominal cost.

The greatest handicap to efficient work at that period was that not sufficient time was allowed for working out the design and for detailing the drawing or for carefully working out the development of the curved surfaces. This was due to the fact that the business was of the single order class; each job was a little different from the rest, and the price of the product did not warrant extensive experimental work. Many of the shops building up-to-date carriages depended entirely on the foreman of the body shop for making the drawings in his spare moments; he was expected to look after the construction of the work for all departments and make the drawings to produce from 50 to 200 jobs per year. To economize his time he would make one working draft with alterations do for several jobs.

During the second period motor car manufacturers built their own bodies, but this did not last very long. To-day there are immense body shops independent of the automobile factories except that they depend on these factories for their orders.

TWO CLASSES OF BODIES

Bodies are broadly divided into two classes, the quantity production body and the custom built or special job. From the money making point of view, the special job is a bugaboo of the trade. With practically very little additional effort on the part of the management and the extra work of detailing the drawings for production, the shop could be set for the entire season.

The special body affords an excellent opportunity of trying out new models for the next season. Cost and workability of the design in production will be the first consideration from the manufacturer's point of view. The value of attractive lines is so well recognized by salesmen that it does not need to be emphasized. That the public still demands distinct body designs is proven by the number of body shops in every city, each of which makes from 25 to 500 special jobs each year. Of course, some of these bodies go to replace those that are worn out before the mechanical part of the car and those destroyed by accidents. You seldom hear of an owner wishing to replace a stock body, and many times the stock body is sold for the price of scrap to give the owner a chance to replace it with one more to his taste.

Body designing in special-job shops is even now quite primitive. The essential points, such as providing for the wheel clearance at the rear fender, door clearance at the fender when open, and proper seat room back of the wheel, are worked out for safety's sake, but the four views showing the side, half back, front and top are mere outline drawings, more or less detailed in different shops. The workman who goes from one shop to another learns that the more the drawing is detailed, the better time he can make building the body, and as this is being realized, more work is being put on the shop draft.

DRAWINGS FOR PRODUCTION JOBS

Complete working drawings are made only when the number of bodies made from one design will warrant the expense. In body work we depend on assembly views more than in any other form of engineering work. The working draft is an assembly drawing; it is made full size, because the curved surfaces are not "true radii" and the patterns to be used for dressing the stock are made from the draft and are checked by laying on the penciled or inked lines, to which they must conform.

This drawing must be made with the greatest accuracy, because the layout man, who takes the drawing after it leaves the table, scales the sizes of stock and dimensions, as very few dimensions are indicated by figures. The sheet of paper on which closed bodies are drawn is usually 62 in. wide and the usual length of the paper is 14 ft. Muslin backed paper is best. This is wetted and stretched tightly on a board, and when dry it will be as tight as a drum head. A base line is drawn about 2 in. up from the bottom, the whole length of the paper, and then 10 in. squares are laid off over the entire surface of the sheet and drawn in with red ink. The reason for this is that any paper will change with changes in the weather. I have experienced a lengthening of ⅜ in. in a sheet from wet to dry weather and by working from the 10 in. squares in taking length and height measurements, the errors are minimized.

It has become common recently to take these drawings on aluminum sheets painted white. The lines are first put on with pencil and when the drawing is finished they are inked in in different colors for the different views, and the whole sheet is varnished. This method not only obviates the trouble of the paper shrinkage but it is a preventive against cutting and tearing.

Besides, changes can easily be made, as the lines can be removed by simply scraping the paint off, and can be replaced as desired.

Most draftsmen use a horizontal board. The vertical board has the advantage that it permits of using more accurate means than the Tee square and the base of the board as a guide line, to work with. But the horizontal board is preferred by most draftsmen because it is more restful to work on, and especially to detail on.

The first step in making a design is to prepare a miniature drawing, generally one inch to the foot. This may be either a simple pencil sketch or a tracing (so that blueprints can be made) and it is sometimes followed by color sketches. These latter permit of bringing out the true proportions of the body and emphasizing its special features. Draftsmen often do not realize that people not familiar with drawings cannot vizualize the object from mere lines on paper. For this reason, and also to make certain that the actual full size job will be as satisfactory as the sketch, full size wax models are made.

For the guidance of the model maker, a full scale rough pencil drawing is made. This man, who is generally a first class mechanic, sets up all the framing and the body boards and puts locks and hinges on the doors. Over the framing he fastens 1 x ¼ in. wood strips, about 1 in. apart and set back the same distance from the outer surface of the pillars and framing. The wax is brought to the consistency of thick putty by heating, and is applied with a scraper, a thin layer being put over the whole framing and the surface smoothened. This is painted, the body is set on a chassis and the fenders, radiator and engine hood are put on.

Sometimes the engine hood is also made in wax, cheap trimming and cushions are put in and the model is completed. Changes in shape can easily be made by adding wax. When a satisfactory form is arrived at the wax is removed, any needed changes in the framing are made, and the whole is then covered with metal panels to form an experimental body.

Credit for creating a system of developing curved body surfaces to produce an harmonious effect belong to the French, and for many years Paris was the Mecca for the young carriage draftsmen who wished to become proficient in his art. A young man who had worked in a carriage shop, and later in a shipyard, suggested to Dupont, proprietor of the carriage trade journal *Le Guide de Carrossier,* the plan of applying geometry to the design of carriage bodies, the same as it is applied in the design of vessels, and Dupont and Brice Thomas between them developed the system of body design in vogue to-day. In recent years the use of this system has been extended, and to-day it has been developed to such a degree that work can be started on the dies for forming the sheet metal panels in advance and production is entirely under control.

The body designer should be the final authority as to any suggested changes in his designs; he should be allowed to make up his models with only such instructions as the general character of the body that is required. His first duty consists in making the sketch. He may be called on for suggestions regarding the painting, trimming and appointments. The design of the radiator outline, the engine hood, lamp supports, tire carriers and fenders are part of his work, because all these parts must harmonize with the body design.

MAKING SHOP DRAWINGS

After the sketch has been approved the next operation is to make the drawings for the shop. However carefully the small drawings may have been, some of the measurements and lines will have to be changed, and the designer should feel at liberty to make such alterations as his best judgment dictates, provided the general effects of the original is still maintained.

The initial work on the working draft must be the work of one man and he must be the best man in the room. Help can be used after the general outline is determined.

As the different views are all put on the one sheet, and some of the views overlap others, no more than two men can work on one design. To distinguish the views, different colored inks are used. Separate detail sheets are used only for the hardware, ironwork and for the die work. The wood framing is not detailed; if the piece is curved, the layout man makes a pattern and samples, and this is given a number just the same as if a detailed drawing had been made. When the drawing is completed a specification sheet is made out, generally on tracing cloth, so that blueprints can be made. Symbols are used for the different pieces forming the groups, and numbers are used together with the symbol letters. All the component parts that form a manufacturing unit are given the same symbol, whether purchased outside or made in the plant. A major symbol is given the complete body assembly.

STANDING BODY DESIGN

The first work in laying out a body design is to determine the extreme length, width and height. After the position of the rear wheel with relation to the dash, the steering wheel location and the shape of the dash have been drawn in, we can determine the seat location. Outer dimensions are governed by the thickness of the framing material and the trimming.

Next, two problemetical curved lines are laid off. One of these, called the turn-under line, shows the gather or narrowing of the body on each side from the widest part at about mid-height to the bottom. The other line, called the side sweep, is a horizontal line showing the gain from the widest part toward the ends. This line is laid out to correspond to the door topline in a closed body and the top edge of a touring body. These two lines, the turn-under and the side sweep, are the major determining lines used to develop the rest of the exterior surface of the body. These lines are not circular arcs but are smooth curves passing through certain fixed points particular to each design.

The draft, when completed, is sent to the layout man who makes the pattern, checks up the methods of framing, marks the numbers on the templets and specifies the number of pieces required. The layout man is a man with shop training; he is generally located near the drafting room and is always available for advice during the time the drafting work is going on.

Manufacturing conditions change, and with improvements in methods it is possible to obtain work that was formerly considered prohibitive. For instance, the fine grade of smooth, soft steel now available for panel stock was not obtainable only a few years ago. Even on hand-made bodies steel is now used to cover the wood framing around the windows in the same manner as aluminum a few years ago. Aluminum sheet can be welded. This saves the uses of multitudinous mouldings to cover the joints, and makes possible the use of narrow panels welded together to cover a large space, such as the roof of a covered body.

Sheet steel is now welded on the job. Several panels may be fastened in place and the joints or laps welded without destroying the wood framing directly underneath. The irregular surface at the weld is wiped with solder and when painted is impossible to detect. Improvements have been made in hinges, locks and folding seats. Rear fuel tanks permit of making the whole job lower.

In spite of predictions to the contrary, the wood frame is retained, although a few manufacturers make what they call an all-metal body in touring types and runabouts. More manufacturers would go into this if body styles were more permanent, but the cost of tooling up and the die work come high, and many manufacturers have lost money trying out the all-metal job, only to find that it cost more than the wood frame construction.

Wood tends to eliminate the clanging or tinny sound produced when all-metal doors are slammed against steel posts. Then, too, some wood must be used to nail the trimming too. This wood, however, is not of the same character as that formerly used for carriages, maple and other cheaper woods having replaced ash, and the Linderman machine, which grooves and glues narrow pieces together, saves much stock that formerly went to waste.

Joining pieces of wood together into large planks or sheets is not new; laminated panels have been used for years, and experience has shown that laminated wood must be protected from the whether by gluing canvass over it and painting. The process here referred to consists in fitting framing pieces together with a dovetail. The machine does all the work of dovetailing, gluing and joining two pieces of stock together in one operation, which is continued on one side until the required width is obtained. This plank is used for sills and other framing parts requiring wide stock. Wood made up in this manner has given the very best results.

Styles originate in the large cities, or at least receive the stamp of public approval there, and travel slowly to the ends of the country. By the time they become popular in the remote places they are out of date in the centers. A few styles are local in

appeal; for instance, the town limousine, lomousine-brougham and the cabriolet are only sold in the large cities like New York, whereas the small two passenger enclosed drive coupé which is essentially a country physician's car, sells only in rural districts. These types, on account of their limited use, are out of consideration for quantity production.

Changes in some particular part of a body sometimes are made without a change in name, but if a body style becomes passé it is killed for all time. Very rarely has this happened to a meritorious design. One exception is the demi-limousine which seems destined to reappear under a new name, as the California top is virtually an adaptation of this once distinctive body type.

LATEST TENDENCIES IN DESIGN

It has been a wonderful progress from the primitive touring bodies to the modern body with its slanting windshield and close curtained top, in which the seat cushions are tipped down at the rear. The rear seat cushion is deeper than the front one, and the rear seat back higher, while the front seat top is kept low to give a low appearance. We place the extra tires at the rear, where weight is needed, and tip the top forward, for the sake of appearance and to minimize the strain on the tire irons.

Low appearance of the car has been a persistently pursued ideal of the trade, and the limit seems to have been nearly reached. A high kick up of the frame at the rear, a low, rakish steering post and blending of the body line with the hood line from the radiator back, have together produced the desired result. This type of car compares in adaptability with the horse phaeton. Attempts to convert it into an all the year body by the addition of a demountable top have not been very successful, on account of the unbecoming appearance of cars with such tops.

In the cities, cars are being driven continuously with the regular touring top up, they being folded only when touring the country. Now that the public has become used to the top as above described, some method of conversion into a quick-change closed job may meet with approval. The Springfield solid roof body with open sides was extremely popular for a time, and would still be in demand but for its mechanical defects.

All types of folding top bodies have been losing in popularity in recent years, possibly because most of these are of European origin and not well adapted to our conditions. The example of the taxicab will illustrate this. At first nothing but a folding top type of body was even considered, but to-day ideas have entirely changed. The standing top job has been cheaper, less given to developing rattles and more durable; it is warmer and more rain proof. The virtues of the folding top are that fine leather has a luxurious appearance when correctly applied in making the folding structure. It is non-sonorous and its rich appearance makes it desirable for exclusive custom built work.

A word should be said about the victoria top, which was adopted from the old horse-drawn park carriage and is easily the daintiest thing ever added to a touring body. It is so attractive in appearance that it is used in spite of its defects for motor car work. If made to allow of being lowered, the window lights will be too small to be serviceable, and if not made that way, much of its beauty is sacrificed. It is a dust trap and the wind resistance that it offers is very great.

Another form of top that did not survive was the disappearing top for open cars which folded into a pocket on the sides and rear of the body. It was not possible to make it look well when up.

The other type of open body, the runabout, is not subject to changes in style to the same extent as the other models.

Among the closed body types, the sedan was the last to appear and it stands alone as the popular closed car. Early samples had the two doors opposite, located for easy entrance to the rear seat, and the front seat divided. Later the doors were staggered, one serving for entrance to the front seat and the other to the rear, while now the general plan is to have four doors and a solid front seat back.

Other types of popular closed bodies are the coupé and town car. There are two styles of the coupé, the small two passenger, suitable for a physician's car, and the four or three passenger coupé. This is essentially a short coupled sedan having two doors at the front, with an entrance to the rear seat through an aisle between the front seats. It is suitable for short wheel base cars, and when used on a large chassis a rear extension similar to that used on a runabout serves to cover the balance of the chassis frame.

The three closed body types above mentioned are the only ones which are manufactured in quantity. The town cars are the cabriolet and the limousine-broughams. There have been no recent changes in these types, and probably none will be made until we have European competition again.

In the past few years we have seen motor manufacturers surrender to body builders on all points regarding which they differed. Stock body models multiplied until manufacturers had 12 to 14, but never have there been so few models and so few radical body innovations as there are to-day. Minor changes in exterior appearance are going on all the time. For instance, the sedan, which has been a slanting front job for over four years.

The lines of both closed and open bodies are more uniformly straight; in fact severe lines are the prevailing fashion. More mouldings are used on closed bodies at present, because they accentuate the straight line effect, and they also permit a form of construction that looks lighter.

Upholstery is not a proper term to use in speaking of the cloth, etc., used in car bodies. It is a furniture term, and carriage builders say "trimming" in speaking of the material and the trimming design in speaking of the manner in which it is cut and laid out. In order to make a durable form of trimming that will stand under hard usage, it is necessary to cut the material into pleats. The pleats hold the filling in place, but the shape is made to permit easy cleaning. Interior mountings are made mostly in lusterless finish, so as to have the entire view "restful" and in soft harmony.

Body design to-day tends to avoid violent contrasts and is striving for quiet elegance in all parts; when one part is changed, others that correlate with it must undergo changes also. Radiators viewed from the front look best when slightly narrower at the top than at the bottom. Rounded corners are used because they facilitate manufacture, but the radius is made small. The height above the frame is 24 to 26 in. and the width, 19 to 24 in., with a decrease of about ¾ in. on each side toward the top.

Some engine hoods slope too much, giving the appearance that the car is plowing into theground. A drop of two inches is the maximum permissible between dash and radiator, and for short hoods a smaller drop is better. Louvres are made small and more numerous, and so are less conspicuous. The body line from the radiator back is really an inverted stream line; a decided gain is made on each side between the radiator and dash without inharmonious effects.

THREE FUNDAMENTAL DIMENSIONS

In body design we have three dimensions which we must conform to. Two of these are arbitrary and sometimes the third is also. These are the width of the radiator, the width of the dash and—in an enclosed body—the necessary hand room between the steering wheel and the inside of the body framing. This latter factor explains why, with a narrow dash we often get a bumpy appearance on the sides of the cowl.

There is no occasion for changing interior dimensions. Closed bodies are at least four inches lower than they were a few years ago; 36 in. from the uncompressed cushion to the roof is as low as the average body can be made; from the cushion to the floor should be 12 to 14 in. If the seat were made lower it would require considerable of an effort to arise from it, especially for stout persons.

In this connection it is interesting to point out that a two passenger coupé could be made shorter than it usually is and still be all right for comfort, but as the height cannot be trifled with, it must have length to balance this or it will look ungainly.

Body designing is different and distinct from other branches of the motor car engineering work. It is difficult to learn because the ability to originate novelties in design comes only after a long process of elimination, oftentimes of many designs, and then working about until just the right combination is hit. Creative work like this necessarily cannot be communicated to another; therefore, the body designer seems always to be taking up work that he cannot utilize help on, and the mystery that is at times blamed on the body designer is the result of the nature of his business. That the occupation survived and enlisted recruits to carry on the work is indicative of the enthusiasm and interest which it instills in those who take it up.

Accessibility Is Featured in Tractor Engine

The piston displacement of this Stearns is 460 cu. in. and it is estimated to develop 40 H.p. at 1,000 r.p.m. It is of the valve-in-head type, the cylinder head is detachable and there is an especially liberal water space in the head casting. The oil pump and drive are one unit and can be removed by taking four cap screws by which the unit is bolted to the crank case and to the main oil lead

THE latest engine specially designed for tractor work is a 4-cylinder block engine of the valve-in-head type, with detachable heads, to be known as the Stearns. The cylinder bore is 4¾ in., and the stroke 5½ in., giving a piston displacement of approximately 460 cubic in. The manufacturer has not given any h.p. rating, but assuming that the brake mean effective pressure is 70 lb. per sq. in., the engine would develop slightly more than 40 h.p. at 1,000 r.p.m

Cylinder barrels are reamed and accurately ground to size. The combustion chambers are reamed to within 0.002 in. in diameter, to insure uniform compression in all cylinders. The cylinder head, which is detachable, is bolted to the cylinder blocks by means of fifteen ⅞ in. studs. There is a very large water space in the head casting, and the inlet manifold, which is of rectangular section, extends entirely through the head, being of uniform shape and size throughout its length. Over each cylinder the inlet manifold has a common wall with the exhaust passage, which assists in the gassification of the fuel. The valve stem bushings are pressed into the cylinder head, and can be easily replaced when worn.

In the design of the crankcase, the aim has been to obtain a maximum of rigidity with a minimum of weight. The main bearings are tied to the side walls with wide flanges, and are supported with two heavy ribs. The bearing caps are set in a recess ½ in. deep, and are held in place by four ⅝ in. studs. Two inspection holes are provided on one side of the crankcase, to allow of the inspection of all bearings. These inspection holes are provided with covers which can be easily removed. The lower half of the crankcase is made in two parts, the lower part acting as an oil reservoir, and also containing troughs into which splashers on the connecting rod can dip. The design is so arranged that all bearing adjustments can be made by removing simply the lower part of the crankcase bottom half, which can be done without interfering in any way with the bearings or oil piping.

OILING SYSTEM

Carbon steel (0.40 per cent carbon) used in the crankshaft, is heat treated and has its bearings ground and lapped to size. The shaft, after it has been completely machined, is balanced on a Norton crankshaft balancing machine. Holes are drilled through the shaft for carrying oil to the connecting rod bearings. At the front and rear ends are oil throwers which minimize the possibility of oil leakage. The connecting rod is also made of 0.40 per cent carbon steel, heat treated. Its cap is held in place by four ½ in. chrome vanadium steel, heat treated bolts, with extra long nuts. A bronze bushing is forced into the upper end of the connecting rod, to form the piston pin bearing.

There is nothing out of the ordinary in the design of the pistons, which are cast of gray iron and provided with three piston rings at the upper end, and four oil grooves at the lower end. The top of the pistons, and the piston bosses are well ribbed. The piston pin is secured in place in one of the piston bosses, by means of a pin screw extending entirely through both sides of the boss, which in turn is locked by means of an ingeniously constructed lock washer. The piston pin is made of 0.20 per cent carbon steel, case hardened.

The camshaft is made of 0.30 per cent carbon steel, with all cams and bearings case hardened and ground to size. This shaft runs in three large bronze bushings. End thrust is taken up on a large flange on the camshaft, and on the front camshaft bearing which is held in place by four machine screws. By taking out these screws, the camshaft can be withdrawn from the engine. The camshaft gear is held in place by a nut and a Woodruff key.

Roller cam followers are used, supported by valve tappets of light, but sturdy design. The roller is made of 3½ per cent nickel steel, hardened and ground. Its pin is made of the same material, and flats are milled on the end to insure the roller remaining in the correct relation to the cam. The valve tappet operates in cast iron bushings, which are held in place by means of a drop forged crab. The push rod cup is a hardened piece.

CRANKSHAFT CONSTRUCTION

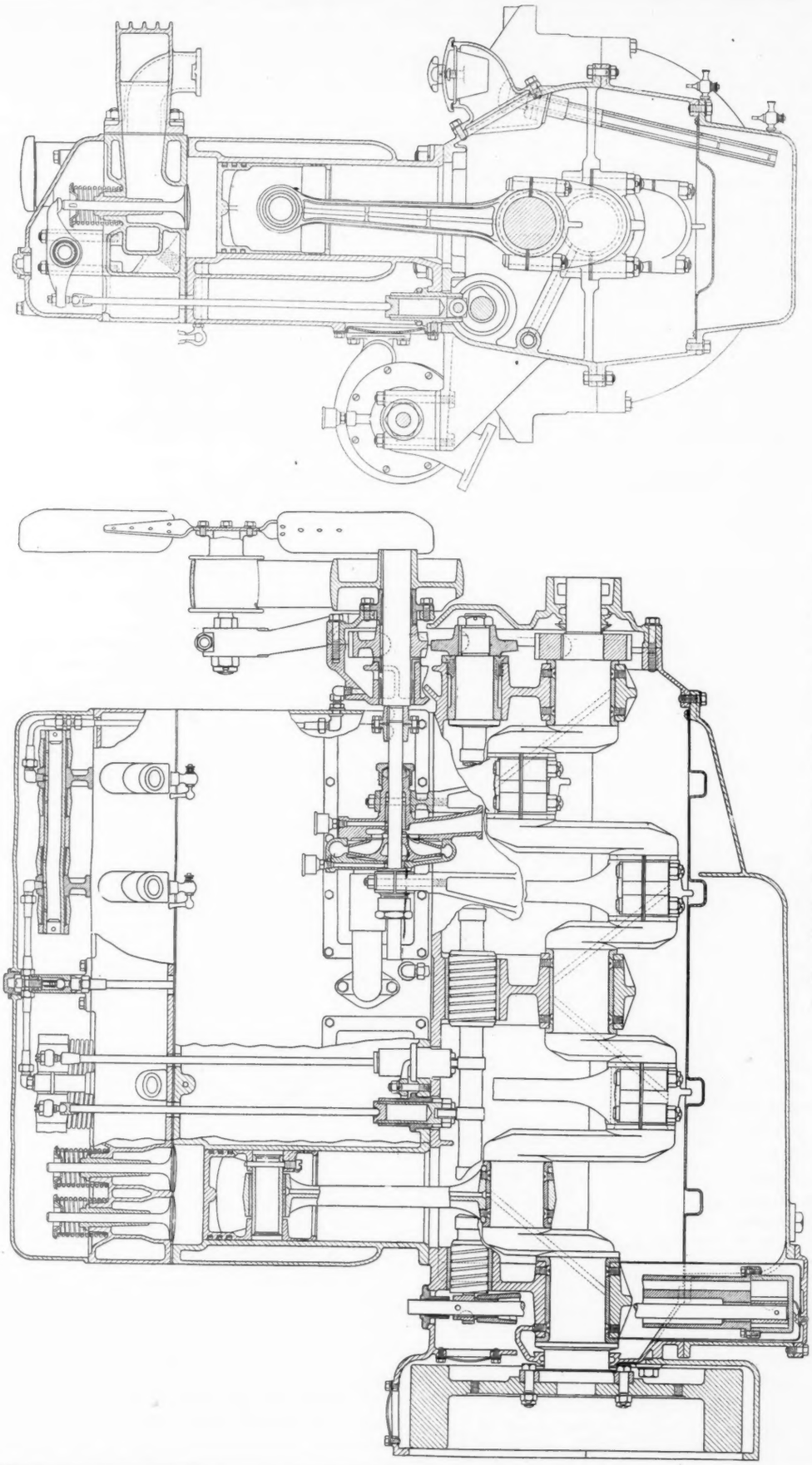
The oiling system is of the force feed and splash type, a submerged gear pump maintaining an oil pressure of 25 lb. per sq. in. on the bearings when the engine is warm. This oil pump and its drive are one unit, and can be removed by taking out four cap screws by which the unit is bolted to the crankcase and to the main oil header. The latter consists of a steel tube, cast into the crankcase, a construction which eliminates the chances of leakage by doing away with all outside oil tubing.

The oil is forced through this cast-in tube to all of the main bearings, and it is then forced through drill holes in the crankshaft to the connecting rod bearings, from which it flows, still under pressure, through a copper tube to each piston pin bearing. Thus, there is force feed lubrication to each of the important bearings of the engine. From the main oil header there is communication through a lateral copper pipe to a pressure relief valve located on top of the cylinder head. This pressure relief valve can be easily adjusted for any desired pressure of oil feed, by simply removing a plug on the cylinder head cover.

The overflow of oil from this pressure relief lubricates the rocker levers through hollow shafts, and also the timing gears. The camshaft is lubricated by large helical oil grooves, which take their oil from the tapered end of the bearings, which in turn receives its oil from the splash and spray in the crankcase.

The engine is provided with a bayonet type of oil gage, and also with high and low level petcocks. In this way the operator can always check the quantity of oil in the base. There is a large oil filler on the side of the crankcase, which permits the operator pouring oil into the crankcase without the use of a funnel. A strainer of ample size is located in the filler, so that all oil is strained before entering the crankcase.

This filler does not act as a breather, and is closed airtight



Longitudinal and cross section views of the Stearns tractor engine, the cylinder bore is 4¾ in. and the stroke 6½ in. giving a piston displacement of approximately 460 in.

when not used, so no dust can be drawn into the crankcase through it. The breather is located on top of the engine, the breathing action being taken up through the pushrod chamber, and through the cylinder head cover. This breather is in the form of a diaphragm valve, which opens when there is an excess of pressure in the crankcase, but closes when there is a suction. It is calculated that this breather action will insure a continual flow of oil vapors through the pushrod chamber and cylinder head, which will lubricate the valves, valve springs, and valve adjusting screw ends.

A centrifugal type water pump is fitted, and is rigidly supported by two brackets bolted to the crankcase. It can be removed by loosening four hexagon nuts. The pump and the fan are driven by a shaft varying in diameter from 1 to 1½ in., which has a bearing surface 4½ in. long. On the outer end of this shaft is located the fan driving pulley. The fan is a 22 in. steel stamping of the hub driven type, and runs on a Hyatt roller bearing. It is driven by a 2½ in. flat belt, the tension of which can be adjusted by simply releasing one cap screw and turning an eccentric in the fan bracket. This eccentric has sufficient eccentricity to allow for 1 in. belt adjustment.

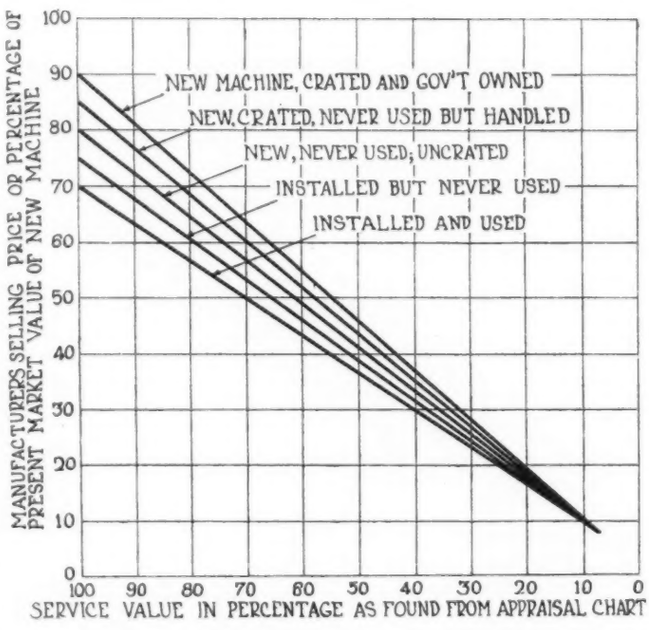
Exhaust and inlet manifolds are cast integral and are of the hot spot type, so designed as to permit of burning heavy fuels. All bearings are of bronze and the main and connecting rod bearings are bronze backed with babbitt lining. The main bearings are 2⅞ in. in diameter, and of the following lengths (front to rear): 3½ in., 4½ in., 4½ in. The connecting rod bearings are 2¾ in. in diameter by 3½ in. long.

Timing gears are 1¾ in. wide and are cut with helical teeth. The crankshaft and magneto drive gears are drop forged from steel, while the camshaft gear is of semi-steel. The engine is so designed that it can be equipped with any standard governor.

How the War Department Will Determine Selling Price of Machine Tools

A CHART has been issued by which the minimum selling price of any machine tool owned by the Government can be determined. The chart is issued by the Director of Sales of the Machine Tool Section of the War Department and is supplemental to one previously issued and which was printed in the July 10 issue of AUTOMOTIVE INDUSTRIES. The former chart was to determine the remaining service value of machine tools left in the possession of the Government at the close of the manufacturing of war munitions.

This minimum sales price is based on that at present asked for a similar machine similarly equipped by the manufacturer. If the machine to be sold is new and crated, the minimum sales price is 90 per cent of the manufacturer's present sales price. If it is new, crated, never used, but handled, 85 per cent; if new, never used, uncrated, 80 per cent; if installed, but never used, 75 per cent.



Method of setting value of government machine tools

For machine tools which have seen practical use the remaining service value is first determined by means of the chart published in the July 10 issue. Then from the chart herewith the minimum selling price in terms of per cent of the manufacturer's price can be found.

Following are instructions for using this chart:

A In using this chart ascertain present market price of a new machine tool of the same size and make and having the same equipment.

B Obtain by use of Chart AAD 440 (printed in AUTOMOTIVE INDUSTRIES, July 10, 1919) the condition of tool in percentage.

C Refer to status of tool, regarding crating, installation, etc., to determine which price line is to be used.

D Enter chart on base line with the condition percentage as ascertained by *B*. Follow vertically to price line as ascertained by *C*. Then follow horizontally to the left margin and read price percentage.

E Multiply this price percentage by the present market value of a similar new machine having the same equipment, and the result will be the minimum selling price which may be accepted for a properly cleared surplus machine tool.

Example: The Graphical Appraisal Chart AAD-440 shows that a "normally used" machine at the end of 4 years has a service value of 72 per cent (*B*). Enter the price chart on the base line (*D*) at 72 per cent. Follow vertically to the price line (*C*), which in this case is taken as "installed and used," then read horizontally to the left margin, which gives the selling price as 51 per cent of the present market price.

Assuming the present market price of a similar machine to be $1,000 (*A*), multiply this $1,000 by 51 per cent (*D*), which gives $510 as the minimum selling price.

Have You a Danger Line in Your Cost Estimates

This is another of the Gear Makers' Convention articles. It is a plea for more and better cost accounting systems and a special recommendation for a system that will accomplish the results of keeping figures on the right side of the ledger. A uniform system for an industry is recommended because it will eliminate the danger of mistakes and competing manufacturers can draw their own lessons from bids read against them

By A. A. Alles, Jr.*

ONE of the most alarming conditions that manufacturers in all lines of industry have had to face is reckless competition. There is a dead-line beyond which no manufacturer can go in making prices. If he knows the dead-line he is safe. If, not, through fear of the loss of sales he will guess at it, only to get the business and suffer a loss of capital in its production. For him to continue to lose spells disaster. To define the dead-line is one of the objects of a cost system. No manufacturer would think of operating his business without one. Some of those in use are accurate, and others not so. This was made plain a few years ago by the Federal Trade Commission's investigation of some 250,000 business concerns, which revealed that only five (5) per cent knew their manufacturing costs.

Many manufacturers place full confidence in their often unreliable systems. Others appreciate that their cost figures are not dependable, but they try to make up for the deficiency by guess work. Still others give their cost-keeping much thought and study, and as a consequence they are getting costs as nearly accurate as it is possible to obtain them. The outcome of all this is a general lack of uniformity in the classification of the elements of cost, with an equal diversity in the methods of apportioning overhead burden, the result being a wide range of production cost for articles of like manufacture.

On several recent inquiries, members of the American Gear Manufacturers' Association are known to have submitted prices which were less than one-half of the general average of prices quoted by others. If selling prices are based on cost of production plus a reasonable profit, then there is an amazing variation in manufacturing costs. Is there so much difference between plants? Or are incorrect costs responsible?

It is common practice among manufacturers, knowingly or unknowingly, to favor a certain class of work at the expense of another in the distribution of overhead, which has the effect of making unprofitable work appear profitable. As the class of work so favored varies with different companies, such procedure is detrimental to every other manufacturer in the same industry.

This situation has existed everywhere. But in the past few years there has been a great awakening. Business-men have come to realize that the life of industry in America depends upon intelligent competition, and that this is only possible where costs are on a sound economic basis. Manufacturers, through trade associations, have given and are giving this subject much study, and it is this which has led to Uniform Cost Accounting.

(Following is a list of trade associations given by the author which have either adopted a uniform system of cost accounting or are about to do so.—Editor):

United Typothetae of America, Electrical Manufacturers' Council, Enameled Sanitary Ware Manufacturers' Association, Laundry Owners' National Association, Paint Manufacturers' Association, The National Implement Manufacturers' Association, The National Lithographers' Association, The Pipe Fitting & Valve Exchange, The National Canners' Association, The National Association of Brass Manufacturers, The National Association of Box Manufacturers, National Association of Steam and Hot Water Fitters, Institute of Cold Rolled Strip Steel Manufacturers, Chair Manufacturers' Association, Portland Cement Association, The Lime Association, Refractories Manufacturers' Association, Folding Box Makers' Association, National Metal Edge Box Association, American Association of the Baking Industries, Printers & Lithographers, National Association of Stove Manufacturers, National Coal Association, American Foundrymen's Association, Steel Founders' Society of America, Association of Ice Cream Manufacturers, National Retail Hardware Association, Southern Pine Association, The National Casket Association.

NOT AN EXPERIMENT

From the above list you will see that uniform cost accounting is not an experiment. It can be accomplished in the gear industry with the patience and whole-hearted co-operation of every member of the American Gear Manufacturers' Association. The success of the undertaking will be measured by the degree of co-operation extended. In conversation a few days ago with R. W. Gardiner, formerly special expert on costs for the Federal Trade Commission, the statement was made that the greatest obstacle to uniformity in cost accounting was the contention of some members of an association that their particular business is different than others. Mr. Gardiner says that in all his experience with the Federal Trade Commission he has never found a single plant where uniform cost accounting methods for the industry would not apply.

It is not contemplated that a standard cost system will be designed for use without alteration in each gear plant. Absolute uniformity throughout will perhaps be impracticable. This, however, need not interfere with the uniform plan which will be constructed on the basic principles of cost accounting applying to all plants. The nearer the standards are attained the closer will be the uniformity.

Practically all gear manufacturers use the special order, or job system. This much is already standard, although uniformity is just as applicable to the process system.

The first step toward uniform cost accounting will be the estab-

*Paper presented at the semi-annual meeting of the American Gear Manufacturers' Association, Boston, Oct. 13-16.

lishment of standard classifications for the items composing the elements of cost, namely:

Direct Material.
Direct Labor.
Factory Overhead.
Administrative and Selling Expense.

Certain items of raw material are classed by some as direct material, and by others as expense. Material purchased for special jobs is charged by some companies at cost; by others it is charged at cost plus various percentages to cover losses; and by still others at cost plus a percentage for handling. Only a small percentage of the direct materials used on jobs is taken from stock on hand at many of the gear plants, the bulk of the materials being specially ordered for contracts. However small the percentage used, proper accounting cannot be made unless a stores system is in operation. To guess at the value of the stores on hand is to guess at the profit for the period in the monthly statement. It would be just as reasonable to estimate the cash on hand at the end of the month as to estimate materials.

There is a variance of opinion at times as to what constitutes direct and indirect labor. Direct labor in one plant is very often considered indirect in another. Direct labor is that portion of the factory payroll which can be charged direct to an order, and in this connection, the importance of accurate time reports cannot be too strongly emphasized. Carelessness in reporting time is responsible for far more errors in costs than is realized. Time consumed on one order and reported on another means that two jobs will be out in the final figures.

FACTORY OVERHEAD ITEMS

This presents the greatest difficulty of all; first, in arriving at the proper amount to be distributed; and second, in its equitable apportionment over the jobs. It is the practice of many of the member companies to make no distinction between manufacturing expense (or factory overhead) and administrative and selling (or commercial) expense, all items of expense being included by them in one overhead sum. The effect of including administrative and selling expenses in production cost is to cause an inflation of inventory values, which practice is counter to Government requirements. The following quotation is from a publication of the Federal Reserve Board, entitled "Approved Methods for the Preparation of Balance Sheets": "It may be well to reiterate that interest, selling expenses and administrative expenses, form no part of the cost of production, and therefore should not be included in the inventory in any shape." From this it would seem that whether selling and administrative expense is 5 per cent or 100 per cent of factory cost, it should not be included in manufacturing cost.

Many of the overhead items will fall naturally into either one of the classifications of factory overhead, or administrative and selling expense. Other items, such as executives' salaries, where time is devoted partly to manufacturing and partly to selling, must be apportioned on an arbitrary basis. The number of items to be distributed arbitrarily and the approximate percentage applying to each classification will necessarily differ in many plants. Some include the item of interest on investment, others do not. Depreciation is another item in the calculation and treatment of which there is wide variation. It is the big item of overhead, and may cause a considerable fluctuation in costs as between plants if not uniformly treated. While there are numerous methods of figuring depreciation, the most common is to charge off the value of the equipment over its productive life, having first deducted the residual, or scrap value. Some of the associations have adopted standards for the life of various assets, which all members use in figuring depreciation. This subject should be given serious consideration.

Some of the companies charge supplies directly to manufacturing expense without first putting them through the storeroom, even though a large supply is purchased for future use. Others more properly charge such supplies to overhead expense as they are actually used; and still others estimate the amount of supplies consumed.

Most of the member companies include in overhead the charge for replacing or correcting defective material, while others permit this to stand against the individual job. The better practice is to charge overhead, rather than the job, with defective work. Where correction will amount to a considerable item and it will be necessary to route the product through the factory, a separate factory order should be entered.

Idle time is another important item. In many plants this is charged to the job on which a man may be working, regardless of the reason for the idleness. In most cases this is properly an overhead charge.

On all these points we should be able to obtain sufficient agreement for all practical purposes, for if the elements of cost are to be as uniform as possible, the items comprising them should be classified alike by all plants.

APPORTIONMENT OF FACTORY OVERHEAD

With the classifications established it next will become necessary to decide upon the best method of apportioning factory overhead. The methods most commonly used by gear manufacturers are:

Total Factory Overhead distributed as a percentage of total direct labor cost.
Departmental Factory Overhead distributed as a percentage of the departmental direct labor cost.
Productive Hour Rate.
Machine Hour Rates.

In some gear plants the productive hour rate is used in one department and a machine rate in another.

A broad and general apportionment of factory overhead is now pretty well recognized as being wrong in principle, and especially so in a machine shop where large expensive and small inexpensive machines are in use, as well as bench workers. The large machine covers more floor space, and therefore its share of building charges are greater; and its depreciation, tool and power consumption are greater; all of which makes the larger machine a very much more expensive proposition to operate than the smaller.

Under the departmental segregation each operating department is charged wtih its own expense. Even after this is done there still remain certain items which must be pro-rated arbitrarily over each department. In many plants factory arrangements are such that departmentalization is not possible, due to the intermingling of the machines. While the departmental rate is more accurate than a general distribution of the total overhead, due to the fact that many items of expense can be localized, it still is necessary to distribute overhead evenly on work passing through the department without regard to variation of machines, unless the plant is departmentalized by machines, or groups of machines, commonly called production centers.

The productive hour method, under which the total plant overhead is divided by the number of productive hours, giving an hourly rate to be charged, is untrustworthy in a machine shop and will not result in correct cost-finding when applied to cheap and highly paid labor working on expensive and inexpensive machines.

MACHINE RATE PLAN

The machine rate plan is theoretically as nearly perfect as any plan can be. Under this method each machine or group of machines or the bench of a handworker, is a production center. Each center is assessed with its annual share, on the basis of floor space occupied, of plant rent, depreciation, insurance, taxes, etc., which, coupled with depreciation of the machine, power cost, tool consumption, taxes, insurance, etc., on the tool, plus the proportion of indirect expense that cannot be allocated on other than an arbitrary basis, makes the total overhead charge which must be consumed by work passing through the production center, on an hourly basis. The hourly rate is arrived at by dividing the overhead chargeable to the production center by the normal operating hours of the unit, or units.

All items, including those which are allocated to production centers as well as those which are not, are gathered together in a monthly shop charge account, which is the total amount of burden. The difference between this and the amount charged specific jobs is by some concerns charged to an Undistributed Burden account at the end of the month, and ultimately charged or credited to profit and loss. Another disposition made by many companies of the undistributed burden is to apportion it over all work completed during the month, on a supplementary rate, which gives them the normal cost and the actual cost on each

job. What the job actually did cost is as important to know as what it should have cost. The machine rate, being the most accurate, is the most complicated.

A variation of the machine rate which is in operation, is mentioned here on account of its simplicity of operation. Costs are not calculated until the end of the month. Factory overhead is distributed on the basis of rated hours, the machines being rated, or classified, as Nos. 1, 2, 3, 4, 5, etc., the classification being the first numeral of the machine's number. The classified is determined by assembling the charges on each machine, as above outlined for the scientific machine rate. By using a small inexpensive machine, or the bench of a handworker, as a base, it is found that one machine has twice the charges to be consumed that another has. A third may have five times as much overhead. The total factory overhead for the month is divided by the total number of rated hours consumed, giving a rated hourly rate for the distribution of the overhead. In operation, five hours turned in on machine 101 equals five rated hours. Five hours turned in on machine 501 equals twenty-five rated hours. Thus the total overhead expense for the month is proportionately consumed by the machines that are in operation.

No matter what method for the diffusion of factory overhead is used, the inequality of machine operating costs must be borne in mind. Lack of appreciation of this is causing perhaps the greatest error in cost accounting.

The distribution of commercial expenses most favored, is on the basis of Cost of Sales, although other methods are used to a certain extent.

Finally, the cost accounting scheme must be so interwoven with the general accounting, that the one will be incomplete without the other. Some of the associations prepare monthly statements of operating costs and other information, which are sent in to the secretary and from which a composite statement is prepared for distribution among the members. While this may be an ideal goal, I think it is going a little too far, at least for the present.

It has been said that a cost system may be a "Thing of beauty but not necessarily a joy forever." No system will operate itself. Means of installation and operation must be provided.

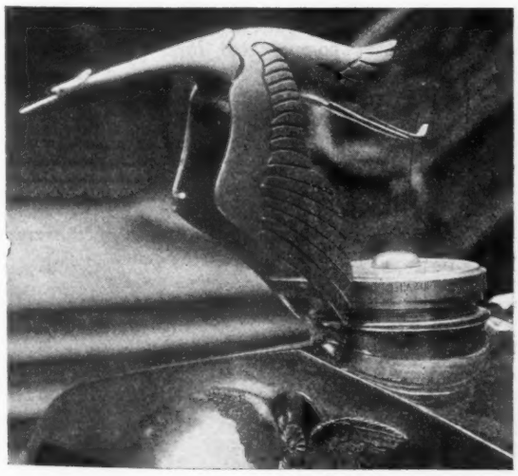
A New Valve Rotator

WHERE mushroom type cam followers are used it is customary to slightly offset the center plane of the cam with relation to the axis of the cam follower, so that the cam follower will rotate around its axis, and the wear on its foot will not be confined to any particular place.

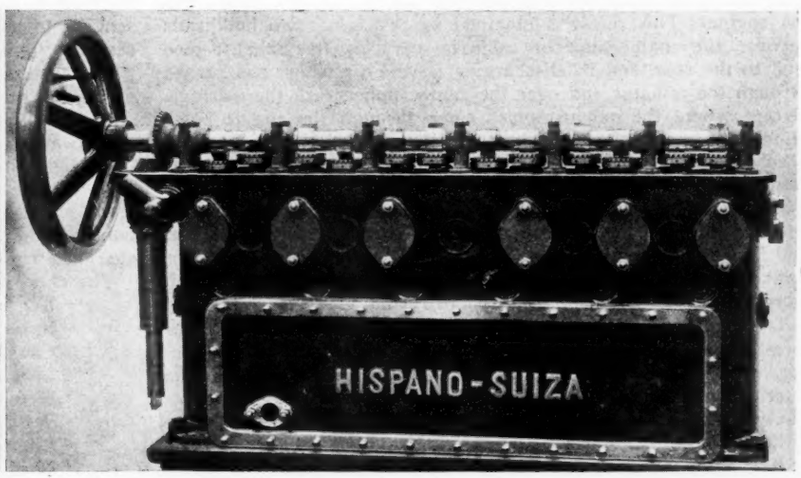
If this rotary motion could be communicated to the valve itself, some rather important advantages would result. Unfortunately, there is a great deal of resistance to the rotation of the valve around its axis, as the valve spring presses with a force of 50 lbs. or more against both the cylinder casting and the valve spring washer, and prevents turning of the valve. To eliminate this resistance, H. McGinley, 135 21st St., Patterson, N. J., has designed a valve rotator or ball bearing spring washer, which, when used in connection with a mushroom type cam follower and offset cam, will insure the rotation of the cam follower being transmitted to the valve itself. The top end of the cam follower or push rod bears directly against the lower end of the valve stem, and motion will be communicated to the valve by the friction between the two parts.

The chief advantage accruing from the use of such a valve rotator is that the exhaust valve head will be uniformally heated over its entire surface. Ordinarily, the head is raised to the highest temperature at that part which is turned towards the cylinder, and the uneven heating tends to cause warping and consequent leakage. If a particle of carbon should stick to the valve seat, and the valve always opens and closes in the same position, pitting will set in. This is prevented if the valve rotates. Owing to the long bearing of the washer on the valve stem, there is no possibility for the spring and washer "cocking," which with ordinary valve construction, and especially where long springs are used, is one of the chief causes of excessive valve stem and guide wear. Another advantage of the ball bearing type of washer is that if the valve stem turns very readily, it facilitates close adjustment of the push rod.

The Hispano-Suiza



This Hispano-Suiza radiator mascot is a work of art



Paris.—The overhead valve mechanism shown in this Hispano-Suiza engine is the type upon which the company is sueing Gnome & Rhone for infringement of patents

A British Air Limousine

This peace time airplane design has some unusual features and one especially that will appeal to prospective passengers—a cabin that is well padded with a view of making it almost soundproof. The idea behind this machine is for small parties, like the family automobile. The construction of the cabin is probably of as much interest at the flying parts, because it is a departure from war-time practice.

ALTHOUGH it is more than a year since the armistice was signed, and the aircraft industries of the different countries have had plenty of time to develop special designs for civilian or commercial uses, so far comparatively little has been announced. A British firm, Petters, Ltd., are now out with a machine designed during the present year for carrying passengers, mails and express parcels over trunk routes.

The machine was constructed at the Westland works of the firm and is known as the Westland limousine.

Referring to the illustrations (for which we are indebted to THE ENGINEER) it will be seen that aero-dynamically the most noteworthy departure from current practice is the provision of a very much deeper and broader fuselage than is usual. This feature has been achieved, the designers claim, without producing a corresponding increase in the head resistance. The cross-section of the fuselage of war machines of corresponding total loads is, of course, much smaller, but the various obstructions which contribute to the fighting efficiency but detract from the "fine lines" of a war-type fuselage are noticeably absent.

The "Westland limousine" is capable of carrying three passengers and the pilot, or 500 lb. to 600 lb. of mail. The passengers are accommodated in a comfortably upholstered cabin which is thickly padded to make it as soundproof as possible.

This latter point is one which merits attention, as, although service pilots have become hardened to it, the roar from the open exhausts of powerful engines is very trying to the average passenger. The noise inside the cabin of the limousine is very little greater than that in the interior of a closed motor car.

An easy entrance to the cabin is provided by a door arranged at the side. Another important point which has received careful attention is the elimination of all smell and oil thrown back from the engine. This result is obtained by arranging two bulkheads between the engine and the cabin by carrying the exhaust pipe well to the rear, and by discharging all the air which has passed through the radiator and over the engine underneath the machine. Except where the exhaust pipes come through the engine cowl, there are no openings in it other than those below the machine. Two adjustable ventilators are provided in the roof of the cabin. Ample lighting is obtained by means of three large triplex glass windows, one at the side of each passenger, two of whom face forward and one aft. The pilot sits on the left of the machine, and his controls are mounted on a staging raised above the floor level. His head is thus lifted above the roof of the cabin, and consequently he obtains a clear unobstructed view.

The construction of the cabin is of considerable technical interest, as there is some difficulty in obtaining efficient cross-bracing, while at the same time leaving plenty of clear space in the interior. The two walls of the cabin are built up of ⅛ in. three-ply wood glued and screwed on to both sides of a spruce lattice girder framework, and are joined together by strong struts and cross-bracing at each end of the cabin, with built-up arches in between. The fittings for holding the lower wings on each side of the cabin are braced together by four ⅜ in. steel tie-rods passing underneath the floor of the cabin. The floor itself is of three-ply carried on a strong under-structure of spruce bearers. The roof is also of three-ply, and is supported on the built-up arches referred to above. The whole cabin is thus a self-contained box quite complete in itself and rigid in every direction. The rear half of the fuselage is of the usual construction, being built up on four 1⅜ in. ash longerons tapering to ⅞ in. at the tail, and is bolted to the cabin by means of channel steel plates.

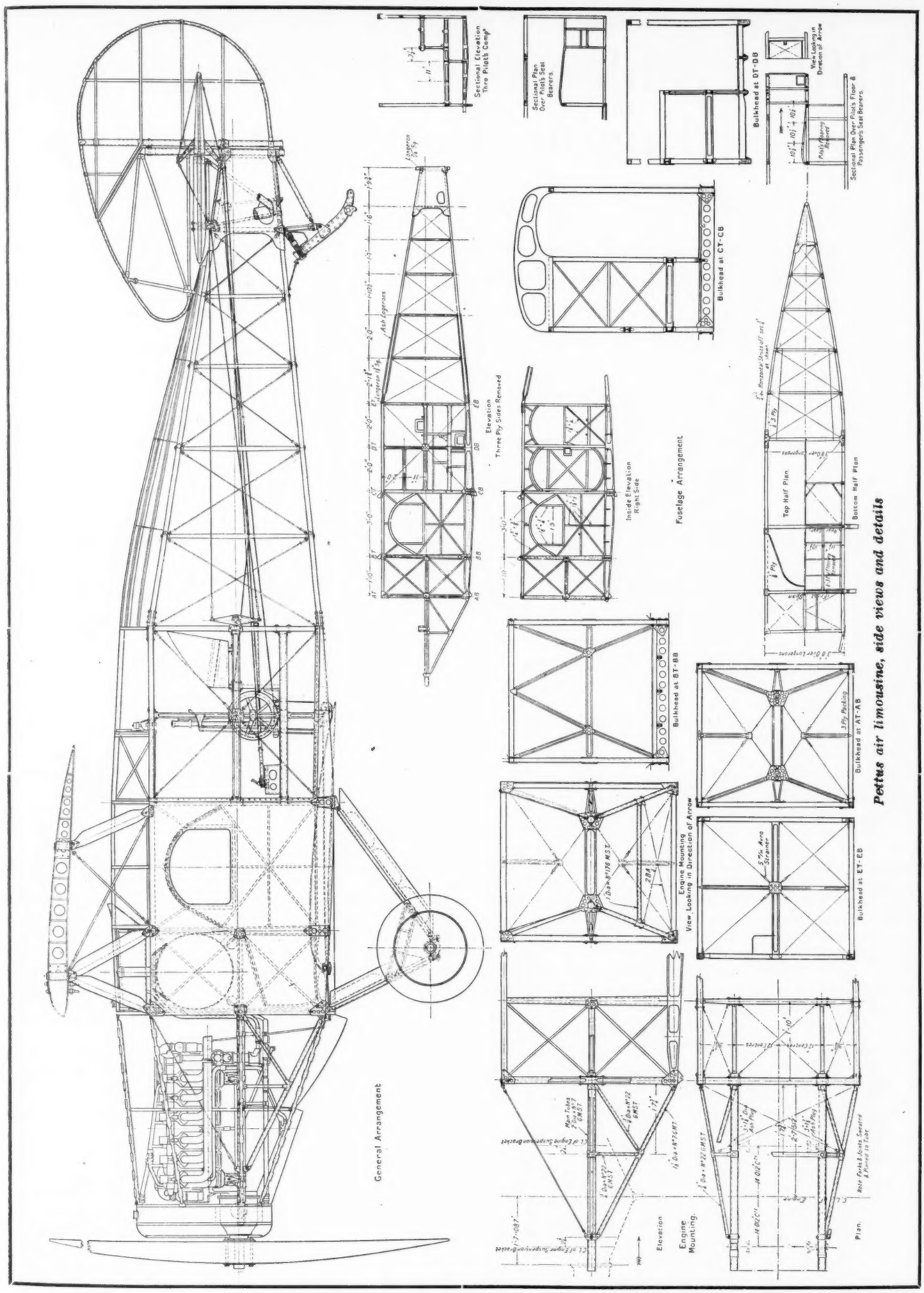
On the front of the cabin is bolted the engine mounting of steel tubing. The unusual width and depth of the fuselage has made it possible to design an exceptionally rigid mounting, and as a result there is no perceptible vibration at any engine speed. The Rolls-Royce Falcon, Mark III engine has been specially modified for the purpose in view. It is estimated that the machine should be able to cover 10,000 miles before even a "top overhaul" is needed, and that double this distance will be easily possible without a complete overhaul.

Fuel is supplied either from a 56-gallon main tank placed between the two bulkheads in front of the cabin or from a small 6-gallon gravity tank on the leading edge of the center section plane. The main tank is under pressure obtained either from a small windmill pump or a hand pump. Should the pressure system fail, the engine can be kept going indefinitely from the gravity tank by means of a hand pump in the pilot's cockpit, which fills up the gravity from the main tank. All the engine controls are worked by means of rods and bell crank levers, and are carried underneath the cabin, where they are easily accessible for inspection and lubrication. The pilot's cockpit is fitted with all the usual instruments and controls. On the left side is a hand wheel for adjusting the incidence of the tail plane. In addition to facilitating landing, this adjustment allows the machine to be trimmed for varying loads, and permits the passengers to move about or change seats, the small change in the center of gravity being easily compensated for.

The trimming gear is of a triangular construction hinged on the front spar, the hinge being also the apex of a tubular triangle. The two other points of the triangle are fixed to the rear spar and to a worm nut respectively. The worm is rotated by means of a light steel cable running over a small drum and passing onto the hand wheel in the pilot's cockpit. As the nut moves along the worm in either direction it carries with it the lower point of the tubular triangle, thus raising or lowering the rear spar and consequently altering the angle of incidence

The chief specifications of the machine are as follows:

Engine	Rolls-Royce Falcon Mark III
Span	38 ft. 2 in.
Chord	6 ft. 3 in.
Length	28 ft. 6 in.
Height	10 ft. 9 in.
Weight	3,400 lb.
Lifting surface	440 sq. ft.
Loading	7.7 lb. p. sq. ft.
Angle of incidence	2 deg.
Dihedral angle	2½ deg.
Stagger	12 in.



Pettus air limousine, side views and details

The Problems in Designing an Engine Camshaft

PART I

In this interesting and important series of articles prepared for this publication, Mr. Hastings goes thoroughly into camshaft design problems. What he says cannot but be of the highest interest to all automotive engineers. He will lift the veil of mystery from some points and make plainer others which some of our readers have seen only dimly. Mr. Hastings will be remembered by many readers for his previous engineering articles

By Don T. Hastings

AMONG the many problems connected with the design of the camshaft is one of the most interesting and important. On its correct design depends to a large extent the proper operation of the new engine.

The principal factors affecting the design are as follows:

1. Valve timing desired.
2. Type of valve operating mechanism.
3. Valve lift.
4. Cost of construction.
5. Location of shaft in engine.

Valve Timing

The timing of the valves is dependent on the maximum and normal operating speeds of the engine and on the fact that the engine is required to operate satisfactorily from idling speed up to its maximum. The time of exhaust valve closing and intake valve opening are not appreciably affected by the engine speed, but the time of opening of the exhaust valve and of the closing of the intake must vary to suit the operating speed requirements. That the above is entirely logical can be seen by reference to Fig. 1. This shows the valve movement in relation to the piston travel.

In an engine running very slowly, we would want the inlet valve open during the entire suction stroke and the exhaust valve open during the scavenging stroke, both valves being closed during the compression and working strokes. It would make no practical difference if either or both of the valves opened or closed 10 deg., or even 15 deg., before or after the piston reached the limit of its travel, as the piston motion during that time is relatively small. The only factor to be considered within these limits would be overlapping of the intake and exhaust valves—that is, having them both open at the same time. This would be objectionable if carried to any great extent due to possible loss of the incoming mixture through the exhaust valve or greater dilution of the new charge by re-entry of some of the exhaust gases. A few degrees overlap is not serious, however, as the actual opening of the valves during the first or last few degrees is very slight.

In an engine built to run at moderate speeds, much better results are obtained, however, by keeping the intake valve open some time after the piston starts on the compression stroke. This is due to the fact that the combustible mixture cannot enter the cylinder fast enough to maintain anywhere near atmospheric pressure during the suction stroke, and, consequently, there is still a partial vacuum in the cylinder and a tendency for the mixture to enter during several degrees of crankshaft motion after lower center is passed. Another factor contributing to the same result is the inertia of the incoming

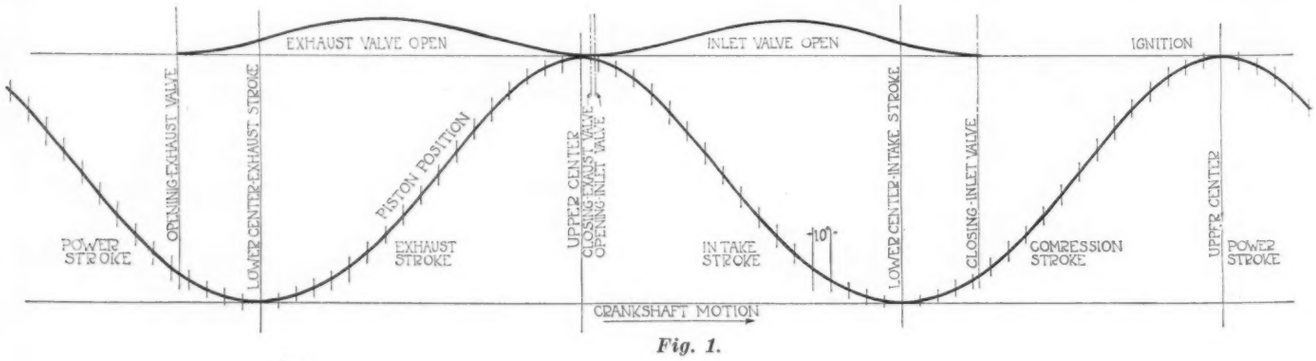


Fig. 1.

Fig. 2.

mixture which tends to make it pack into the cylinder for a short time after the suction stroke is completed.

Similarly, it is found that increased power is obtained if the exhaust valve is opened slightly before the piston reaches the end of the working stroke. The result of this change is to reduce the amount of burned gas left in the cylinder at the end of the exhaust stroke, and, consequently, permit the entrance of an increased volume of new mixture. The gain in power due to this increased amount of new mixture more than offsets the loss at the end of the working stroke, which is relatively small owing to the rapid decrease of pressure in the cylinder as the gases expand and also to the fact that the leverage exerted on the crankshaft by the connecting rod during this part of the stroke is rapidly approaching zero.

The closing of the exhaust valve should still take place approximately at the end of the exhaust stroke, as the pressure in the cylinder has decreased by this time almost to atmospheric pressure and, consequently, practically no more of the burned gas will be discharged if the valve is held open after the end of the stroke. The intake opening should occur as before, either just after or slightly before the closing of the exhaust valve.

In high speed engines, the closing of the intake valve should be still farther delayed and the exhaust opening take place still earlier for the same reasons as given above. For the same reasons, also the exhaust closing and intake opening will still take place at or slightly after the end of the exhaust stroke of the piston.

Many tests in confirmation of the above reasoning have been made and present practice in valve timing as shown in Table I is conclusive proof that it is correct. Considerable liberty is taken in the choice of figures by various designers but there is a general agreement in engines of various types.

The average figures for modern high speed engines used in airplanes, passenger cars and trucks as obtained from this table are as follows:

Intake opens 8 deg. after top center.
Intake closes 43 deg. after lower center.
Exhaust opens 45½ deg. before lower center.

Table 1—Valve Timing

	No. of Cyls.	Type of Follower	Clearance
	4	M	0.005
	6	M	0.003
	6	M	0.004
	4	1⅛ R	0.004
	6	M	0.002
	6	1⅜ R	0.004
	4	⅛ R	0.005
Liberty	12	⅛ R	0.015 inlet 0.020 exhaust
	6	1¼ R	0.010
	4	M	0.002
	8	M	0.0075
	6	M	0.003
	4 & 6	M	0.0035
	6	M	0.0075
	4	1 R	0.004
	4 & 6	M	0.004
	4	M	0.003
	4 & 6	M	0.0025
	6	M	0.003
Packard	12	⅛ R	0.005
Cadillac	8	R	
Hupp	4	M	0.003
Ford	4	M	0.015
Average of above			
Tractor—800 r.p.m.	4	M	0.004
Winton Diesel, 250 r.p.m.	6 & 8	R	0.015
Foreign Engines			
Salmson-French	9	R	
Ricardo-English, 1,200 r.p.m.	4 & 6	R	
Austro Daimler	6	R	0.010 0.012

	Intake		Exhaust		
	Opens	Closes after center	Opens before center	Closes	Quieting Curve
	on center	35	45	6 after	yes
	7 after	55	49	10 after	yes
	5 after	35	45	on center	no
	15 after	50	45	10 after	no
	12 after	40	50	10 after	yes
	13 after	42	45	10 after	yes
	5 before	35	40	on center	no
	10 after	45	48	8 after	no
	10 after	45	46	5 after	yes
	18 after	30	42½	8 after	no
	on center	35	45	6 after	yes
	8 after	40	45	6 after	no
	5 after	50	45	on center	yes
	12 after	43	40	10 after	yes
	15 after	45	45	10 after	no
	8 after	45	50	5 after	no
	10 after	30	45	5 after	no
	5 after	49	49	5 after	no
	on center	50	50	10 after	yes
	9 after	42½	47½	4 after	yes
	4 after	47½	47	3 after	?
	12 after	44	44	12 after	yes
	13 after	50	37	on center	no
	8 after	43	45½	6 after	
	10 after	15	30	10 after	no
	5 before	25	40	on center	no
	on center	55	65	on center	?
	20 after	17	55	5 after	?
inlet exh.	10 before	30	45	7 after	?

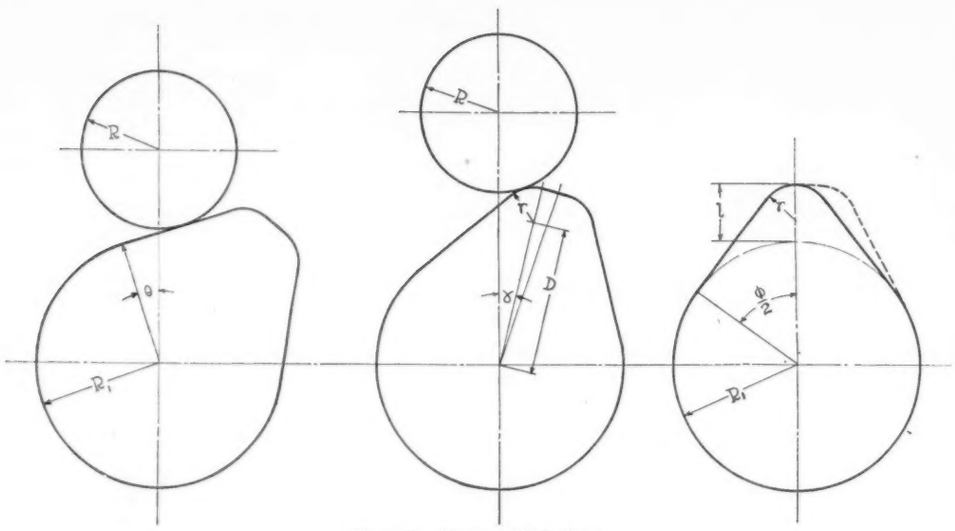


Fig. 3. Tangential Cam

Exhaust closes 6 deg. after top center.

These figures exclude the experimental designs and various freak timings and can be taken as representative of the best practice in this country. Fig. 2 shows this timing in the usual crankshaft diagram form.

An interesting comparison with the above is the timing of the French Salmson airplane motor, which has been remarkably successful. In this engine the early opening of the exhaust and late closing of the intake have been carried considerably farther than on American engines.

In the Ricardo engine, which was developed for use in the British tanks and runs at a maximum speed of about 1,200 rpm., the intake timing is quite unusual, the duration of opening of the valve being much less than is customary.

The Austro-Daimler is notable for the extreme overlap of the valves, amounting to 17 deg.

The figures given for one of the prominent tractor engines which develops its maximum power at and is governed to 800 rpm., show appreciation on the part of the designer of the importance of suiting the timing to the speed desired.

The timing of the Winton Diesel engines follows motor car practice a little more closely than would be anticipated for engines running at only 250 rpm.

Valve Operating Mechanism

There are three types of cam and follower in general use. They are:

1. Tangential cam with roller follower.
2. Mushroom cam with flat faced follower.
3. Constant acceleration cam with roller follower.

Use is sometimes made of a round end follower which gives, theoretically, the same action and results as the roller follower, the radius of the rounded end being equivalent to the radius of a roller. Actually, excessive wear would be expected as compared to a roller or mushroom follower working under the same conditions of lubrication, pressure and speed.

One of the three types of cam is used regardless of valve position in reference to the cylinder—that is, for example, the same tangential cam may be used in an L head engine with direct action through the tappet to the valve stem, or in an overhead valve design with long push rods and rockers, or in a design having both valves and camshaft overhead.

The tangential cam is the oldest of the three designs. The mushroom comes next, while the highly developed constant acceleration cam has been in use only during the last few years.

Practically all cams are made symmetrical — that is, with the lift and closing curves the same and are so considered in the following paragraphs:

The Tangential Cam

The tangential cam is so called because its two flanks are formed by lines tangent to the base circle at the points of opening and closing of the valve respectively. The top of the cam is formed either by a circular arc joining the two flanks, the point of maximum lift of the valve then being at the intersection of this arc with the cam centerline, or by two circular arcs each of relatively small radius and each joining one of the flanks to a third circular arc concentric with the base circle. In this case, the valve is held wide open while the roller is in contact with this third arc and the cam is said to have a certain number of degrees dwell.

When the cam has a single arc connecting the flanks, as shown by the full line in the right hand diagram of Fig. 3, the angle of lift, $\frac{\Phi}{2}$ is equal to one half the angle through which the camshaft turns while the valve is off its seat. If, as is frequently the case with tangential cams, a period of dwell is provided, $\frac{\phi}{2}$ is the actual angle through which the camshaft turns while the valve is being lifted or allowed to return to its seat. This condition is represented by the dotted outline in the same diagram.

The radius of the base circle of the cam is represented by R_1, the top radius by r, the lift by l, the radius of the roller by R and the distance from center of cam to center of radius r by D, all being expressed in inches.

The relationships among these quantities are shown in the two following equations:

$$D = R_1 + l - r \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$R_1 = r + l\,\frac{\cos\frac{\phi}{2}}{1-\cos\frac{\phi}{2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

No attention is paid in the following discussion of the cam shapes to the clearance which it is always necessary to leave between the valve and tappet, or between tappet and cam in order to insure the valve seating. The valve and other parts of the engine expand as the engine warms up when running, with the result that this clearance usually varies. This is discussed below, under the heading of "Clearance and the Quieting Curve."

To determine mathematically the lift, velocity and acceleration at any point during the lift of the valve, the lift period must be divided into two parts, that during which the roller is in contact with the flank, as shown in the left-hand diagram of Fig. 3, and that with the roller in contact with the top radius, as shown in the central diagram. θ is the angle in degrees through which the

camshaft has turned since the roller became tangent to the flank, and γ is the angle still to be turned before the valve is completely lifted with the roller in contact with the top radius. Each of these angles reaches its maximum when the roller is in contact with the cam at the point where the top radius is tangent to the flank, when the following relationships exist:

$$\theta \text{max.} + \gamma \text{max.} = \frac{\phi}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$\tan \theta \text{max.} = \frac{D \sin \frac{\phi}{2}}{R + R_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

With the roller in contact with the flank of a tangential cam, the following formulae apply:

Lift—in inches—

$$l = \left(R + R_1\right)\left(\frac{1}{\cos \theta} - 1\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Velocity—in feet per second—

$$V = \frac{1}{12}\left(R + R_1\right)\left(\frac{2 \pi N}{60}\right)\left(\frac{\tan \theta}{\cos \theta}\right) \quad \ldots\ldots\ldots\ldots\ldots (6)$$

Acceleration (always positive) in feet per second^2—

$$a = \frac{1}{12}\left(R + R_1\right)\left(\frac{2 \pi N}{60}\right)^2 \left(\frac{1 + \sin^2 \theta}{\cos^3 \theta}\right) \quad \ldots\ldots\ldots\ldots (7)$$

With the roller in contact with the top radius, the following formulae apply:

Lift—

$$l = \sqrt{(R + r)^2 - D^2 \sin^2 \gamma} + D \cos \gamma - (R + R_1) \quad \ldots\ldots\ldots\ldots (8)$$

Velocity—

$$v = \frac{1}{12}\left(\frac{2 \pi N}{60}\right)\left[\frac{D^2 \sin \gamma \cos \gamma}{\sqrt{(R + r)^2 - D^2 \sin^2 \gamma}} + D \sin \gamma\right] \quad \ldots\ldots\ldots\ldots (9)$$

Acceleration—

$$a = -\frac{1}{12}\left(\frac{2 \pi N}{60}\right)^2 \left[D^2 \frac{D^2 \sin^4 \gamma + (R + r)^2 (1 - 2 \sin^2 \gamma)}{\left\{(R + r)^2 - D^2 \sin^2 \gamma\right\}^{3/2}} + D \cos \gamma\right] \quad \ldots\ldots\ldots\ldots (10)$$

The acceleration becomes a maximum when $\gamma = \theta$, i. e., at full lift when

$$a = -\frac{1}{12}\left(\frac{2 \pi N}{60}\right)^2 \left(\frac{D^2}{R + r} + D\right) \quad \ldots\ldots\ldots\ldots\ldots (11)$$

The valve spring pressure in pounds required at full lift is

$$F\text{max.} = \frac{W N^2}{35200}\left(\frac{D^2}{R + r} + D\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

In the above formulae

N = camshaft revolutions per minute maximum.

W = weight in pounds of valve, tappet and its parts and one-half the weight of the valve spring.

The pressure of the valve spring is required to hold the roller in contact with the cam only during the period while the roller is in contact with the top radius. The pressure required when the roller first comes in contact with this radius, i. e., at γ max., should be determined and compared with the pressure given by the spring at this point of partial lift. Ordinarily the spring pressure is greater at this point than required, but trouble might be experienced if very heavy wire were used in a spring having a small initial tension. The spring pressure needed at this point can be determined by the mormula.

$$F_{\gamma \max} = \frac{W}{32.16} \times a_{\gamma \max} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

The minimum free length permissible in the valve spring to insure contact of the roller with the cam at all times, letting L_c represent the length of the spring when fully compressed, i. e., with the valve wide open, is

$$L = L_c + \frac{F\text{max} \, (l\text{max} - l_{\gamma \max})}{F\text{max} - F_{\gamma \max}} \quad \ldots\ldots\ldots\ldots\ldots (14)$$

As the actual spring is usually specified to give 10 percent to 15 percent greater pressure than that computed for the wide open valve at maximum speed, in order to allow for variation and to provide for friction, there is generally no trouble through lack of tension with the valve partly open.

A set of curves of valve lift, velocity and acceleration computed from the above formulae are shown in Fig. 6 and discussed below.

The Mushroom Cam

The mushroom cam, shown in Fig. 4, takes its name from the flat-faced or mushroom-like follower with which it must be used.

The sides or flanks of the cam are circular arcs of radius R tangent to the base circle at the points of opening and closing of the valve and connected at the top of the cam by a circular arc of radius r. There is no reason why a period of dwell similar to that for the tangential cam could not be allowed on a mushroom cam, particularly for exhaust valve cams which have a greater period of opening than the corresponding inlet valve cams, but such is not the case in present practice.

The symbols of Fig. 4 have the following significance:

R = flank radius in inches.
R_1 = base circle radius in inches.
r = peak radius in inches.
D = distance from center of cam to center of radius r in inches.
l = lift in inches.
γ = angle still to be turned before valve is entirely opened—degrees
θ = angle through which camshaft has turned from start of valve lift—degrees.

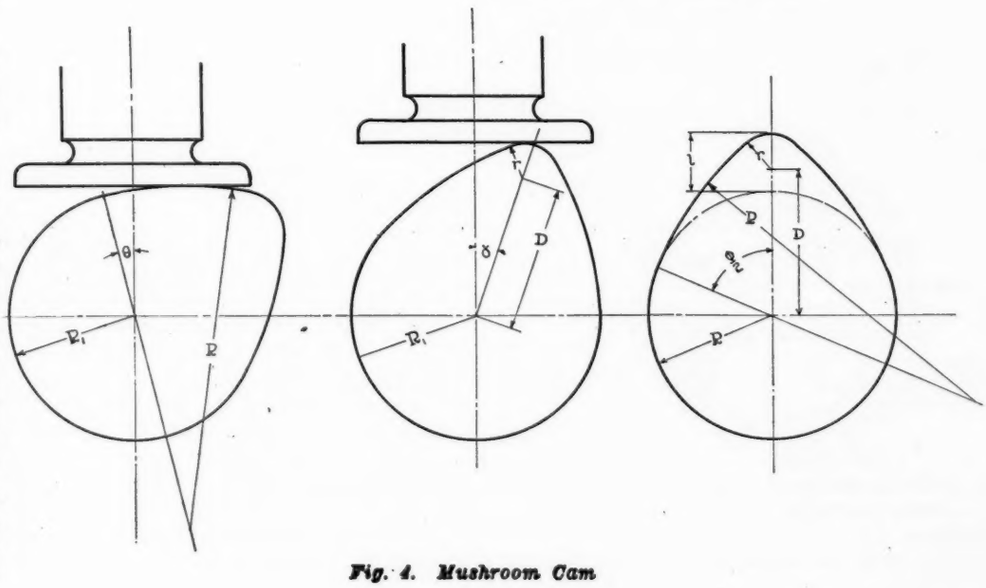


Fig. 4. Mushroom Cam

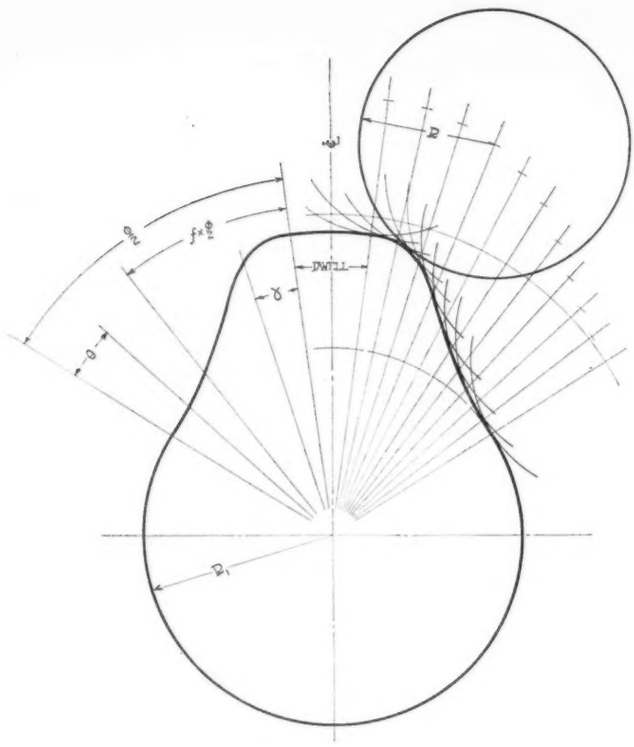


Fig. 5. Constant Acceleration Cam

$\frac{\phi}{2}$ = one-half of angle turned by camshaft during period valve is off its seat, or if a period of dwell is allowed, the angle of motion during which valve is lifted—degrees.

The relationship of parts is as follows:

$$D = l + R_1 - r \quad \ldots\ldots (15)$$

$$R = \frac{D^2 - r^2 + R_1^2 - 2\,R_1\,D\cos\frac{\phi}{2}}{2\left(R_1 - r - D\cos\frac{\phi}{2}\right)} \quad \ldots\ldots (16)$$

$$R > r + D\cos\frac{\phi}{2} \quad \ldots\ldots (17)$$

The angles θ and γ are each a maximum when the follower is in contact with the point of tangency of the arcs forming the flank and top of the cam when

$$\theta\,\max + \gamma\,\max = \frac{\phi}{2} \quad \ldots\ldots (18)$$

$$\sin\theta\,\max = \frac{D}{R - r}\sin\frac{\phi}{2} \quad \ldots\ldots (19)$$

As in the case of the tangential cam the lift period must be divided into two sections for mathematical treatment.

With the follower in contact with the flank curve, the following formulæ apply:

Lift—in inches

$$l = (R - R_1)\ (1 - \cos\theta) \quad \ldots\ldots (20)$$

Velocity—in feet per second

$$V = \frac{1}{12}\left(R - R_1\right)\sin\theta\left(\frac{2\,\pi\,N}{60}\right) \quad \ldots\ldots (21)$$

Acceleration—in feet per second per second—always positive

$$a = \frac{1}{12}\left(R - R_1\right)\cos\theta\left(\frac{2\,\pi\,N}{60}\right)^2 \quad \ldots\ldots (22)$$

With the follower in contact with the arc, whose radius is r, the formulæ are as follows:

Lift—

$$l = D\cos\gamma + r - R \quad \ldots\ldots (23)$$

Velocity—

$$V = \frac{1}{12}\,D\sin\gamma\left(\frac{2\,\pi\,N}{60}\right) \quad \ldots\ldots (24)$$

Acceleration—

$$a = -\frac{1}{12}\,D\cos\gamma\left(\frac{2\,\pi\,N}{60}\right)^2 \quad \ldots\ldots (25)$$

The acceleration becomes a maximum when $\gamma = 0$, that is just as the valve reaches its full lift, in which case

$$A_{max} = -\frac{1}{12}\,D\left(\frac{2\,\pi\,N}{60}\right)^2 \quad \ldots\ldots (26)$$

The spring pressure required to hold the follower in contact with the cam is maximum when the valve is fully lifted and can be computed from the formula

$$F = \frac{W\,D\,N^2}{35200} \quad \ldots\ldots (27)$$

As in the case of the tangential cam the spring pressure required at the point when γ is a maximum should be computed and compared with the actual pressure given by the spring at this point of partial lift. The formula for the spring pressure required is

$$F_{\gamma max} = \frac{W\,N^2\,D\cos\gamma\,max}{35200} \quad \ldots\ldots (28)$$

The minimum free length permissible for the valve spring can be computed as before by use of formula (14).

The quantities W and N have the same significance as for the tangential cam.

Mushroom Tappet Diameter

The maximum distance, A, from the center line of the tappet, measured in the plane of the cam, at which the cam touches the tappet can be computed from the equation

$$A = (R - R_1)\sin\theta\,max = D\sin\gamma\,max \quad \ldots\ldots (29)$$

Mushroom tappets are usually offset in the plane of the centerline of the camshaft from the center of the cam face, in order to insure the rotation of the tappet and thus constantly present a slightly different surface to the rubbing action of the cam. The distance from the centerline of the tappet to the farthest edge of the cam and the distance determined by equation (29) form the two sides of a right angled triangle whose hypotenuse represents the minimum radius of the flat face of the tappet. It is usual to allow $\frac{1}{16}$ in. to $\frac{1}{8}$ in. additional on this radius to take care of variations in manufacture and alignment of the parts.

Lift, velocity and acceleration curves for typical mushroom cams are shown in Figs. 6 and 7 and are discussed later.

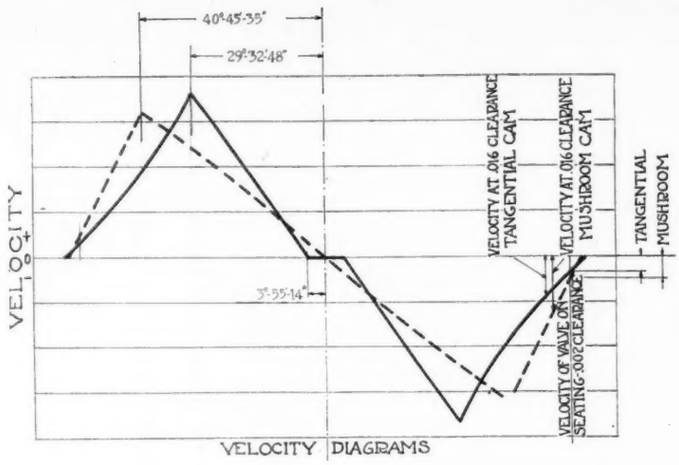
The Constant Acceleration Cam

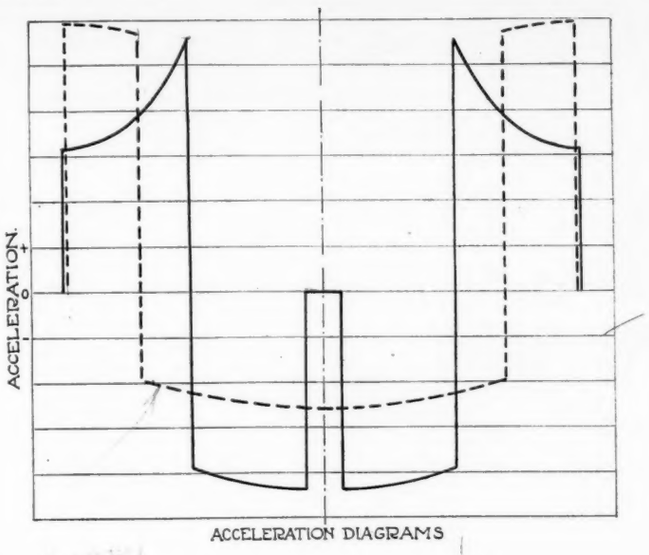
The constant acceleration cam, shown in Fig. 5, is, as its name implies, a cam so shaped that the acceleration and deceleration of the valve and roller tappet are each uniform during part of the lift. The acceleration and deceleration may or may not be the same, as will be explained.

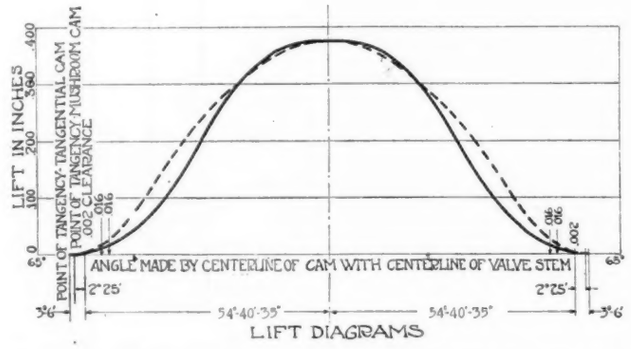
The significance of the reference letters is the same as for the tangential cam.

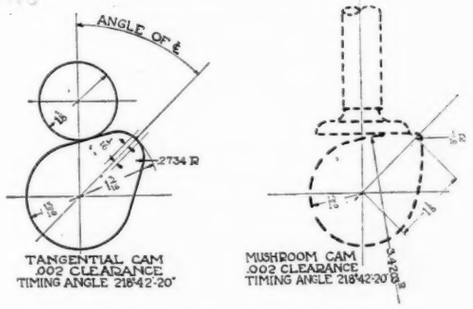
In the two preceding cases, the shape of the cam was first determined and then the curves of lift, velocity and acceleration were computed and the strength of the valve spring determined. In this case, the start is made with the acceleration and then, in succession, are determined the velocity, lift, and finally the cam shape.

Originally, constant acceleration cams were made with the acceleration and deceleration equal. This resulted in the acceleration and deceleration periods being equal and in the valve being lifted one-half of the total distance in one-half of the total time of lift. As the spring pressure required, however, depends solely on the decelera-









tion, present practice is to increase the proportion of the lift time devoted to deceleration with, of course, a corresponding decrease of the time for acceleration, resulting in lower values for the deceleration and consequently for the spring pressure required.

Calling the fraction of the lift angle in which deceleration takes place f, and expressing $\frac{\phi}{2}$ in degrees, the following formulæ apply:

Acceleration—in feet per second per second

$$a = \frac{6N^2 l}{\left(1-f\right)\left(\frac{\phi}{2}\right)^2} \quad \ldots\ldots (30)$$

Deceleration—in feet per second per second

$$d = \frac{6N^2 l}{f\left(\frac{\phi}{2}\right)^2} \quad \ldots\ldots (31)$$

Maximum velocity—feet per second

$$V \max = \frac{Nl}{\frac{\phi}{2}} \quad \ldots\ldots (32)$$

Velocity curves are straight lines from zero at the beginning and ending of the lift to the maximum at an angle $f \times \frac{\phi}{2}$ before the top of the lift is reached.

Lift at point of maximum velocity

$$l_{v\max} = (1-f)l \quad \ldots\ldots (33)$$

Lift curve from $\theta = 0$ to $\theta = \left(1-f\right)\frac{2}{\phi}$

$$l_\theta = \frac{l_{v\max}}{\left[(1-f)\frac{\phi}{2}\right]^2}\theta^2 \ (\theta \text{ in degrees}) \quad \ldots\ldots (34)$$

Lift curve from $\gamma = 0$ to $\gamma = f\frac{\phi}{2}$

$$l_\gamma = l - \left[\frac{l - l_{v\max}}{\left(f\frac{\phi}{2}\right)^2}\right]\gamma^2 \ (\gamma \text{ in degrees}) \quad \ldots\ldots (35)$$

The following relationships exist

$$\theta \max = (1-f)\frac{\phi}{2} \quad \ldots\ldots (36)$$

$$\gamma \max = f\frac{\phi}{2} \quad \ldots\ldots (37)$$

$$\theta \max + \gamma \max = \frac{\phi}{2} \quad \ldots\ldots (38)$$

It will be noticed that neither the radius R of the roller nor R_1 that of the base circle, is involved in these formulæ. Before the shape of the cam can be determined, it is necessary to compute the lift for each one, three or five degree interval. When these figures are available the procedure is as follows, reference being made to the right hand half of Fig. 5:

Draw the base circle with radius R.

Concentric with this, draw a construction circle whose radius is equal to $R_1 + R$.

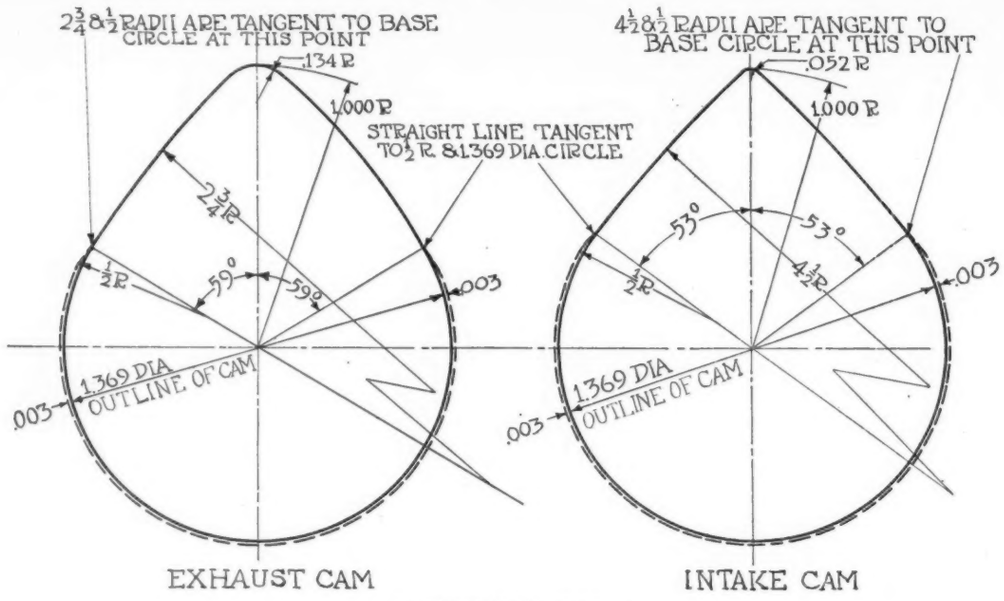
Draw radial lines at one, three or five degree intervals as previously used in computation of lift.

Lay off lift on radial lines, measuring outwardly from circle of radius $R_1 + R$.

With the points thus located as centers, strike arcs of radius R.

The irregular curve tangent to all these arcs on the side toward the center of the cam and also tangent to the base circle and to the circular arc for the dwell at the top of the cam is the cam outline.

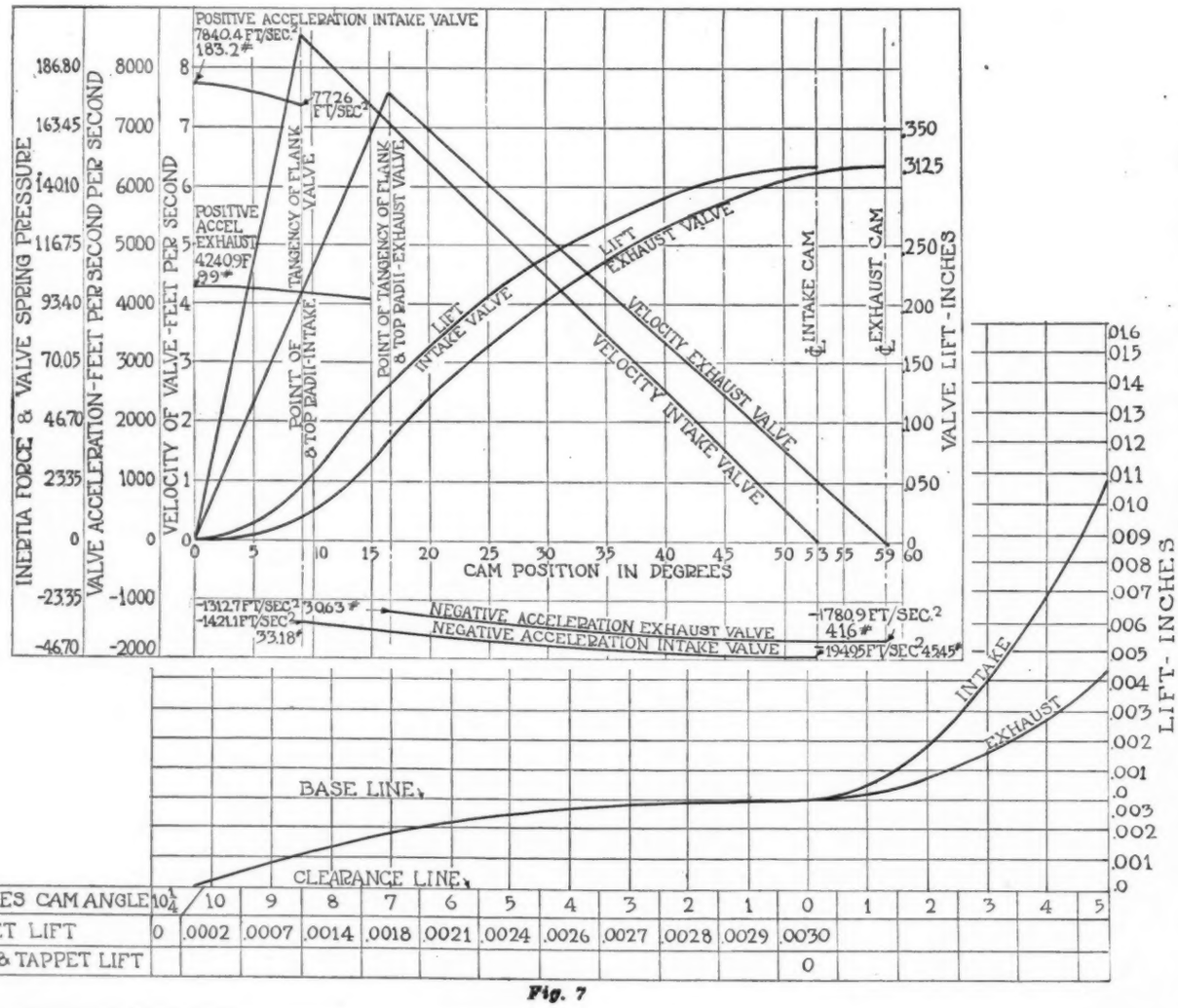
A fair approximation to this irregular curve is obtained by the use of two circular arcs and a straight line between and tangent to them, the arc tangent to the base circle being concave outwardly and the arc tangent to the dwell period arc corresponding to the peak radius



MUSHROOM CAMS

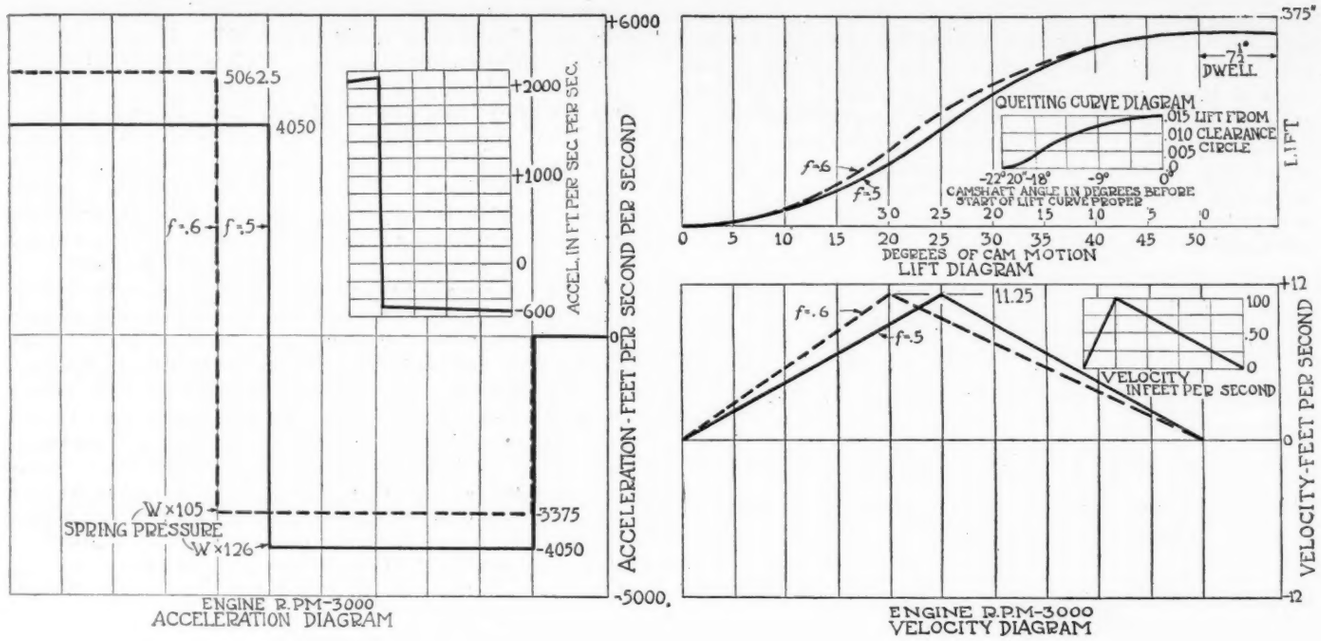
Fig. 7

QUIETING CURVE



DEGREES CAM ANGLE	10¼	10	9	8	7	6	5	4	3	2	1	0	1	2	3	4	5
TAPPET LIFT	0	.0002	.0007	.0014	.0018	.0021	.0024	.0026	.0027	.0028	.0029	.0030					
VALVE & TAPPET LIFT												0					

Fig. 7


+6000
5062.5
4050
+2000
+1000
0
-600
ACCEL. IN FT PER SEC. PER SEC.
f=.6
f=.5
W×105
SPRING PRESSURE
W×126
3375
-4050
0
-5000.
ACCELERATION-FEET PER SECOND PER SECOND
ENGINE R.P.M-3000
ACCELERATION DIAGRAM
.375"
7½° DWELL
QUEITING CURVE DIAGRAM
.015 LIFT FROM
.010 CLEARANCE
.005 CIRCLE
0
-22°20'-18° -9° 0°
CAMSHAFT ANGLE IN DEGREES BEFORE START OF LIFT CURVE PROPER
30 25 20 15 10 5 0
f=.6
f=.5
0 5 10 15 20 25 30 35 40 45 50
DEGREES OF CAM MOTION
LIFT DIAGRAM
LIFT
+12
11.25
100
50
0
VELOCITY IN FEET PER SECOND
VELOCITY-FEET PER SECOND
-12
ENGINE R.P.M-3000
VELOCITY DIAGRAM

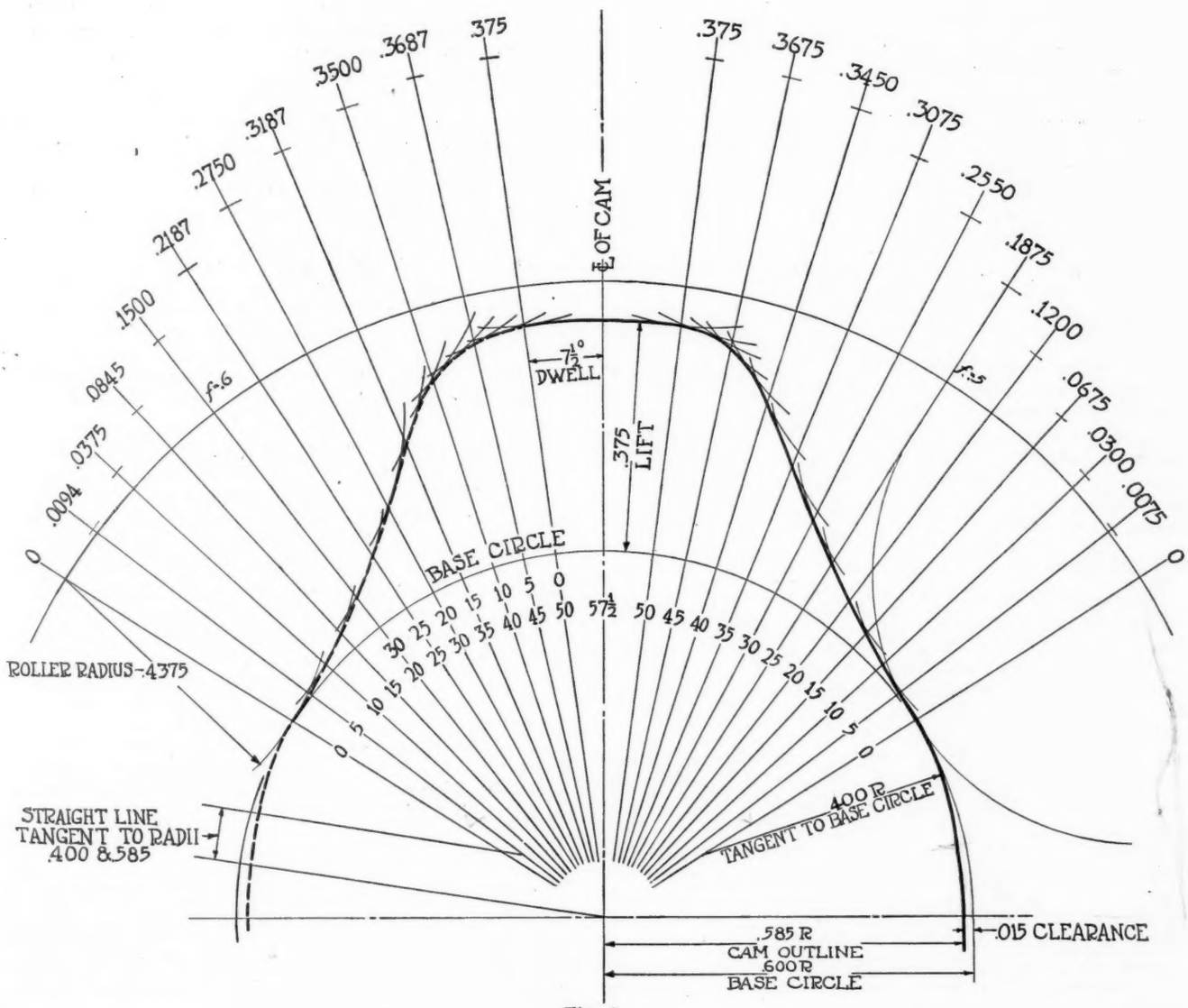

℄ OF CAM
.375
.3687
.3500
.3187
.2750
.2187
.1500
.0845
.0375
.0094
0
.375
.3675
.3450
.3075
.2550
.1875
.1200
.0675
.0300
.0075
0
7½° DWELL
.375 LIFT
f=.6
f=.5
BASE CIRCLE
30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 57½ 50 45 40 35 30 25 20 15 10 5 0
ROLLER RADIUS-.4375
STRAIGHT LINE TANGENT TO RADII .400 & .585
.400 R TANGENT TO BASE CIRCLE
.585 R CAM OUTLINE
.600 R BASE CIRCLE
.015 CLEARANCE

Fig. 8

of a tangential or mushroom cam. It is quite common practice to detail constant acceleration cams in this way, but by far the better practice is to specify the lift desired at the various angular positions, making the intervals as small as desired to insure accuracy of outline.

The formulæ for the constant acceleration cam in which the acceleration and deceleration are equal, are somewhat simpler than those for the general case, being as follows:

Acceleration = deceleration

$$a = \frac{12N^2l}{\left(\frac{\phi}{2}\right)^2} \quad \ldots\ldots(39)$$

Velocity—maximum—unchanged

$$V\,max = \frac{Nl}{\frac{\phi}{2}} \text{ occurs at an angle } \frac{1}{2}\left(\frac{\phi}{2}\right) \quad \ldots\ldots(40)$$

$$\text{Lift at angle } \tfrac{1}{2}\left(\frac{\phi}{2}\right) = \frac{l_{max}}{2} \quad \ldots\ldots(41)$$

Lift curve—first half

$$l_\theta = \frac{2\,l\,max}{\left(\frac{\phi}{2}\right)^2} \times \theta^2 \quad \ldots\ldots(42)$$

Lift curve—second half

$$l_\gamma = l_{max} - \frac{2\,l_{max}}{\left(\frac{\phi}{2}\right)^2} \times \gamma \quad \ldots\ldots(43)$$

Two constant acceleration cams with their lift, velocity and acceleration curves are shown in Fig. 8 and are discussed below.

The spring pressure required to maintain contact between the roller and the constant acceleration cam is given by the formula

$$F = \frac{W\,N^2\,l}{5.36\,f\left(\frac{\phi}{2}\right)} \quad \ldots\ldots(44)$$

Particular attention is called to this, as it is the pressure required at the point of maximum velocity, that is, at the angle $(1 - f)\frac{\phi}{2}$ from the start of the lift instead of at the point of maximum lift, as in the case of the tangential and mushroom cams. The pressure at the points of maximum lift will be greater in the proportion of the remaining lift to the amount the spring has been compressed to secure the computed pressure. This increase will usually amount to $\frac{1}{10}$ to $\frac{1}{5}$ of the pressure at the point of maximum velocity with the average about $\frac{1}{8}$.

Special Cams

The cams discussed above have all been symetrical about the centerline. This is by no means necessary and many cams have been designed and a few built in which the opening and closing curves were different. In addition, the centerline of the tappet has occasionally been offset in the case of the tangential or constant acceleration cam in the endeavor to obtain a lower average side thrust on the tappet. None of these designs has been markedly successful, however, and it may be taken for granted that no particular gain is to be made in this way.

Internal cams have been used to a limited extent, notably on motorcycles, but it may be said in general that they are apt to give very high accelerations, necessitating the use of much stronger springs than are ever provided if the valve tappet is to follow the cam. In one case it was found that a 130-lb. spring was needed to get the proper action at 3,000 r.p.m. of the crankshaft, the moving parts weighing only 0.7 pound.

Among the interesting experimental designs, which have as yet not been made in quantity, is one involving variable intake valve closing. This is accomplished by using a cam having a valve opening period of about 170 deg. instead of the usual 105 deg. to 110 deg. in connection with a special rocker lever which is so mounted as to be capable of movement across the camshaft. This results in keeping the intake valve open from the normal closing position at one extreme of the rocker lever sideways movement, to a closing about 20 deg. before top center of the crankshaft in the other extreme rocker position. This design was worked out to give variable compression and works excellently, it being easily possible to throttle the four-cylinder engine down to a road speed of about 1 mile per hour with ordinary rear axle reduction of about 4 to 1. The compression with normal inlet closing is about 75 lb. gauge and varies down to about 15 lb. gauge with the rockers at the other extreme position. This is cited merely to show how flexible a design can be made while still employing the same general principles as in ordinary practice. The rocker constitutes practically a mushroom follower, with the result that sideways motion of the rocker does not affect the time of intake opening.

Valve Rocker Levers

All of the cases already considered have included only valve tappets having straight line motion and valves whose travel was the same as that of the tappet. This is by no means always the case, as most engines using overhead valves employ rocker levers to transmit the motion from cam to valve. There are also some L head engines which employ a rocker lever usually so proportioned that the point giving motion to the valve stem has greater travel than the point in contact with the cam. Great care must be exercised in such cases to insure correct use of the formulæ.

In the case of the simple one-armed rocker lever, a sufficiently close approximation to the correct weight to be accelerated can be obtained by determining the weight resting on the cam when the pivoted end of the rocker is supported freely in its regular working position. The assumption that this weight reciprocates as would an ordinary tappet will be very close, as the angle of motion of the rocker is quite small.

When the rocker lever is double ended, a good approximation can be made by considering it as two separate single-armed levers and proceeding as above for the cam end. Then determine the weight of the other end which would rest on the valve stem and treat it in the same way.

When one end of the rocker is longer than the other and the valve lift is greater than that of the cam, the velocity and acceleration of the valve and the long end of the lever will both be increased directly in proportion to the lengths of the lever arms.

(To Be Continued)

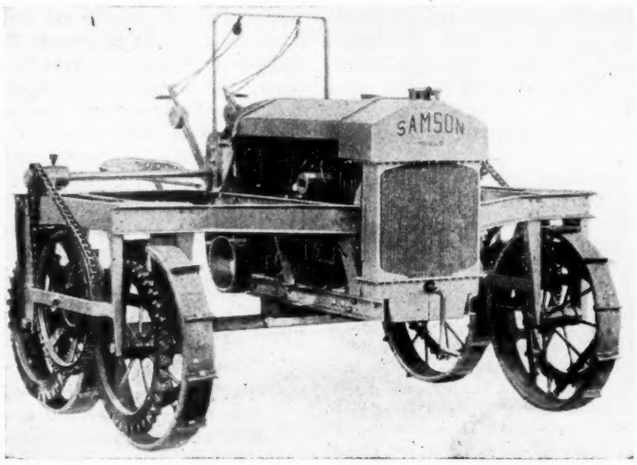
IT IS announced by the American Chamber of Commerce at London that several English-Scottish oil companies have amalgamated, forming Scottish Oils, Ltd., with a capital of $20,000,000.

REPORTS of the Central Argentine Railway state that arrangements are being made for the use of fuel oil in driving the locomotives, instead of coal, and more recently wood. It is hoped that in the early part of 1920 about one-quarter of the system will be running on that fuel, by which it is anticipated a material saving in running expenses will be effected.

The Iron Horse Designed for General Farm Work

Light tractor does many things the heavier machines are not adapted to. It has four wheel drive, high ground clearance, and is steered by driving on one side, or ahead on one side and reverse on other. Top half of crankcase is cast integral with the block of four cylinder engine. Control by lines from tractor to implement

THERE is a good deal of work on every farm for which the ordinary two or three plow tractor is not well suited, because of its excessive power, its great weight, and its low ground clearance. For such lighter work the Samson Tractor Co. has developed a special machine known as the Iron Horse. This is a light tractor of great maneouverability, which can be used for pulling a 7-ft. single disk harrow, a 2 section drag, an 8-ft. binder, a manure-spreader, all hay tools, a cultipacker, a weeder, a roller, a two-row corn cultivator and a loaded wagon. Except when used for corn cultivation, when the operator rides on the Iron Horse, the machine is controlled by means of two lines from the implement.



The Iron horse light tractor

Described in a few words, the Samson Iron Horse is a light four-wheel drive tractor with high ground clearance which is steered by driving on one side only, or by driving forward on one side and backward on the other side. The machine is of four-wheel construction, having a very wide tread and short wheelbase. The maine frame is built up of channel steel, with downwardly extending forks for the driving wheels at each corner.

The engine is of the four cylinder type with detachable cylinder head and the top half of the crankcase cast integral with the cylinder block. The lower half of the crankcase is also of cast iron. The engine has a four point support on a sub-frame, which is hung from the main frame. Overhead valves are used, and are operated by pushrods extending up the side of the engine. The fuel tank is located over the engine and fuel feed to the carburetor is by gravity. Ignition is by a Simms magneto. There is a short exhaust pipe at the right of the engine, which is surrounded by an air heater for the carburetor. A gear type oil pump is mounted at the forward end of the magneto drive shaft. The radiator at the front of the machine is of the conventional truck type with cast and bolted top and bottom tanks.

Back of the engine the power is transmitted through a bevel gear to a cross shaft on which there are four belt pulleys. Short fabric belts connect these pulleys to four other pulleys vertically above them, of which the two outer ones serve for the forward drive, and the two inner ones for the reverse. The two inner driven pulleys, are, of course, not on the same shafts as the outer pulleys, but are mounted on short shafts located somewhat higher up, which are geared through spur gearing to the cross shafts on which the forward drive pulleys are mounted.

All of the belts are loose and can be tightened sufficiently for driving purposes by means of idler pulleys on their forward side, one set at a time. These idler pulleys are controlled by means of two levers, which are so arranged that when moved forward and upward, the reverse gear is applied, and when moved backward and downward, the forward speed is secured.

These levers are provided with weights, adjustable along their lengths, which hold them in such a position that the forward speed is applied, and the operator can reverse by simply pushing these levers forward. When turning a corner, the lever on the outside is retained in the position for forward drive, while the lever on the inside is either moved to the neutral position or to such a position that the reverse gear will be applied, so that one set of wheels will be moving forward, and the other set backward. Control lines can be hitched to the ends of the levers, so as to make it possible to operate and control the Iron Horse from the implement pulled.

To the outer end of the two cross shafts are secured chain sprockets, and there is a large reduction by roller chain to a short cross shaft mounted between the two driving wheels on each side. This shaft also carries a small lantern wheel, which meshes with a sprocket wheel of a large diameter on each of the driving wheels on one side. Thus power is transmitted equally to all four wheels when driving straight ahead.

The Iron Horse runs on gasoline, carrying a supply of 10 gallons in the tank over the engine. Its speed can be varied from 1 to 3½ m. p. h., the gearing being such that at 1200 r. p. m. of the engine the tractor speed is 3 m. p. h. The weight complete without tools is 1950 pounds.

Decreasing Labor Cost Despite the Prevalent Unrest

This article by Mr. Tipper is all facts. Mostly he writes theory that, if put into practice, would do the industry much good but this w k he is telling what one plant has done by making facts of theories. The mere suggestion of decreasing labor cost and bringing labor turnover to zero under after-war conditions will make most any production manager take notice

By Harry Tipper

TO GET a plant, a machine shop employing 2,500 men, to the point where wages can be increased 53 per cent and labor decreased 25 per cent should be inspiration enough for any man interested in production and industrial progress.

I had that kind of an experience the other day when I took sufficient time at the Bullard Machine Tool Works to go thoroughly into the records of the human side of their business. The inspiration was not lessened by the fact that this result has been accomplished with the simplest of organization machinery and with very little red tape.

But this is not by any means the most important part of the story.

The records show that on the same job with the same machines, the same operators and even the same jigs and fixtures, they have increased the per man per hour production 142 per cent since 1916.

In most industrial establishments the production manager, or the executive in charge of production will look back regretfully to 1916 and wish that he were getting as good a per man per hour production as he did at that time. Here is a concern which can look back on that year and see an improvement in the individual efficiency of 142 per cent. **Even this statement does not suggest the work which has been done in the Bullard organization.**

It needs the additional fact that in the beginning of 1915, after the stoppage of business in 1914 on account of the war, the number of workers was little more than 200 and now is 2,500, with the final statement, that the turnover is practically non-existent today, to suggest the full importance of the work which has been accomplished in its indication of what can be done, when the main side of industry is studied with patient intelligence and with a desire for its solution.

The most important contributing cause to this result in the eyes of the Bullard executives, is the establishment of complete confidence in the minds of the workers. It is the spirit of square deal which permeates the whole organization that is most apparent to an investigator, not merely the square deal as it is generally understood indicating that there is no desire to rob, or swindle, or brow-beat, or force a man, but a square deal in its broader understanding.

The square deal which they speak about in this plant reminds me of the Roosevelt idea of the same phrase. It involves an understanding of the other fellow and consequently patience with him; education, giving him the reasons for what he had done; recognizing his individual desire for respect, and being careful of his individual sensitiveness. The just business transaction is only the by-product of the individual outcome of a spirit of this kind, instead of being its first evidence.

Of course, these things were not accomplished over night, and they were not the result of the adoption of a particular system of operation nor the work of a specialized industrial department. The attempt to clothe a system with the power to settle human troubles is unsatisfactory and absurd in any case. Every system which has been considered, has made a success in some plants and has been a failure in others. The best which a system can do is to provide machinery by which to build up a better understanding, where the understanding does not exist without it.

In the Bullard organization the necessity for understanding seems to have been built into the very foundation of the business. It is reported in the statements of the older Bullard, who founded the business, and in his relations with his workers, long before labor union, collective bargaining, limitation of production and other modern theories had arisen to confuse the mind with the idea that "system" was the panacea.

The generation of the Bullard family who are now running the business, worked their way through their father's shop, absorbing the spirit of the organization, carried it forward and amplified its usefulness.

How thoroughly this was done is indicated by the fact that even when there were only 200 of the old employees left, they could build a new Bullard organization back to 2500 and still retain the spirit; so that they have improved the production, decreased the labor costs and stood like a rock, without any disturbance, during the strikes which occured from time to time in that strike-ridden town.

Of course there are systems in connection with this organization, and for the practical benefit of the reader it is important to refer to them, but if the subscribers of AUTOMOTIVE INDUSTRIES could have been with me at the plant of this company, the system would have fallen into its proper place as a simple instrument with which to put into effect the spirit of square deal which is so thoroughly exemplified. As a matter of fact, they do not refer to it as a "square deal" in this organization. Occasionally it is referred to as "Golden Rule." That is what the president of the company and his brother executives regard as the principle they are trying to put into practical operation.

From time to time these articles in AUTOMOTIVE INDUSTRIES have emphasized the uselessness of machinery or organization systems and other instrumentalities unless there is behind them an intention to be square, to deal fairly with the worker and to deliver the goods to the worker with a sense of obligation just as keen as the sense of obligation to the stockholder.

There is no system which has been investigated that can prevent strikes or settle grievances unless the spirit of fair-play is behind it all. Even with that spirit, it takes patient labor and a lot of it, to remove the suspicions that exist, and establish confidence, so that the machinery can co-operate to its full capacity.

It has taken all the time since 1915 to date, to secure out of the Bullard organization the results which have been mentioned, and the executives of this company stated many times the necessity for constant promotion of the policy to the men, constant development of the reasons why for every action that is taken and a constant reminder of the thought and understanding of the executive.

In respect to the foremen, Stanley Bullard, in answer to a question, remarked that they were being trained and kept up to the Bullard ideal by constant application and education. In the days of building the organization back from 200 odd men who were left in the stoppage in 1914 when the outbreak of the European war brought business to a standstill, the new Bullard organization which was being built up, suffered a high turn-over in labor like all other manufacturing plants.

The executives came to the conclusion that good work could not be accomplished in an organization where the men were here today and gone tomorrow, that there was something wrong with an organization that could not keep its men and satisfy them and still do business, so they got down to find out what fundamentals were necessary in order to provide this stability of service.

This idea finds expression in the first page of the booklet describing the wage system and other matters of interest to the Bullard employes:—

Therefore to obtain or to increase productive capacity is not merely a problem of a number of operatives or of increasing the number of operatives, but rather one involving the retention of operatives and increasing their skill and ability through a constantly growing familiarity with the work and co-operation.

After having established a plan on which to build up a satisfactory system for the practical application of their ideals, they put into print and laid down for the employees the four principles upon which this system was based:—

1st. That respect and confidence between employer and employee shall be established and maintained.

2nd. That a proper and equitable incentive must be provided for both.

3rd. That there must be established a measure for determining a rate of wage.

4th. That the rate of wage must be definitely related to energy, skill, experience and knowledge required to perform the work.

The wage system which developed out of these four principles was a system based upon an hourly rate, an efficiency increase and a bonus plan. In common with other systems of the same kind, it provides an individual incentive for improvements in efficiency by increasing the pay with the efficiency increase, but it goes much further than the original system in that respect.

Steps which an employee can take from the lowest class to the position as foreman, are stated and classified, so that any man can see what he must do to pass from one grade to another, and what his prospects and possibilities are. In other words, the curriculum of the school is laid out, and the man in the first grade knows what he must accomplish to the second, third, fourth, etc.

Not only that, but whenever a man reaches a higher grade by virtue of his work, his rate of pay automatically increases. It does not wait upon his asking for it, or upon the recommendation of a foreman. As soon as he has satisfied conditions which merit an increase, he receives a notice giving his first pay under the new grade and stating on the back:

Your advancement in Classification and attendant increase in hourly wage is the direct result of your own effort.

It pleases the Company greatly to thus reward your work and we trust that you will continue to advance.

In other words, when a man has passed through the grade and his examination, he is automatically increased in his pay and is advanced to the next grade. He never has to ask for anything which is coming to him because of his work. The Bullard plant is run as an open shop as it always has been. It has an apprentice system which is quite unusual; the branches of the apprentice school are indicated here as an important part of the system:

The branches of the Machinist's Art and Trade, with the respective number of working hours required, inclusive of trial period, are as follows: (For rate per hour, see Card.)

TURNING:
1½ Years of 2500 Hours a Year.
VERTICAL BORING MILL:
1½ Years of 2500 Hours a Year.
HORIZONTAL BORING MILL:
1½ Years of 2500 Hours a Year.
PLANING:
1½ Years of 2500 Hours a Year.
MILLING:
1½ Years of 2500 Hours a Year.
DRILLING:
1 Year of 2500 Hours.
GRINDING:
1 Year of 2500 Hours.
ERECTING:
1½ Years of 2500 Hours a Year.
TURRET MACHINE:
1 Year of 2500 Hours.
VISE WORK:
1½ Years of 2500 Hours a Year.
SCRAPING:
1½ Years of 2500 Hours a Year.
GEAR CUTTING:
1½ Years of 2500 Hours a Year.

Wages will be paid on the regular pay days

There are very few shop notices in the Bullard plant. Whenever the executives have something about which they wish to inform, about which they wish to talk to the employees, each worker receives a personal envelope with the information contained therein. He receives this when he is going home at night, checking out at the time office, so that he can read it over at his leisure and if necessary, talk it over with his folks.

No announcement is made to any employee without a reason being stated in connection with the announcement. For instance, the condition of the street car service necessitated a change in the night shift schedule. The notices which were sent to the night men on this started something like this:—

"On account of the following conditions in connection with the street car service, etc."

When it is necessary to have some emergency night work and some men are to be told off for it, instead of being approached by the foreman late in the afternoon they are notified from the office as long beforehand as possible by a personal note. During the period immediately following the armistice, when conditions in shops with war contracts were very uncertain, the Bullard Company issued notices to each employee in the shops, engaged upon government work, stating the exact condition, stating specifically that each employee would be given plenty of time to determine his future plans when any such notice was required and also stating that the Bullard Company hoped to be able to place them.

During the time the war Labor Board was studying the Bridgeport situation while we were at war, the Bullard Company issued notice after notice to each employee acquainting them with the situation, with the position of the Bullard Company and with the general necessities of the case. Nothing was left to rumor or misunderstanding; before any unrest could appear because of lack of information, the company took its employees into its confidence, all of them, and fully informed them of the situation.

In all these notices the reasons are given so clearly that they can be understood readily, the notices are worded and delivered so as to emphasize the personal relations of the worker with the Company to meet his self respect and to appeal to his intelligence.

Of course the Bullard Company have the usual welfare movements in their organization, although these are not arranged with the lavishness to be observed in many places, everything which is necessary for clean working conditions, healthy surroundings, first aid and other matters are provided by the company, in addition to their insurance plans not only provide for the worker's protection while at work, but they also provide for his protection outside of work, in accident, in health, and in life-insurance.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Production and the Coal Strike

DUE to the delay of the publication of this issue, the causes of which have been explained well, it is possible to make mention here of the serious results of the coal shortage caused by the strike of the miners. Without going into the reasons for or in any way commenting upon the actions of the miners in walking out at this critical time in the nation's industrial history, it may be said that the present partial tie-up of the automotive industry will entail much upon the personnel when a settlement of the coal strike shall restore stocks and make full production possible once more.

Output must reach the high level as quickly as possible when coal stocks again begin to move. The shortage at home and abroad means that cars, trucks and equipment must be furnished. The American factories in large measure must furnish them. The American worker, whether he be factory head, plant official, mechanic or laborer, must do the work.

He must in some measure make up for the production lost because of the coal tie-up. The cars must be furnished some time; they are needed today and will be tomorrow. Full production then must become the slogan in the producing plants of the United States when that becomes possible again.

European Practice

WITH the London and Paris shows out of the way, AUTOMOTIVE INDUSTRIES directs its readers to the various accounts and articles published in the last few issues showing the after-war development and construction of the European makers. Attempts have been made to show all that was new and worth while in the building of Europe's cars. Much that is novel and much that is radical in comparison with American practice have been shown in in these various articles. This commands the attention of American engineers for the reason that foreign cars shortly will be in sales competition with the products of this country. Europe naturally will seek to regain her lost export markets. Many of her makers will endeavor to invade this country.

Brakes on Trailers

IN recent years there has been a growing use of trailers in connection with motor trucks, and, as the practice seems to have given satisfaction, there is every likelihood that it will grow. It has been puzzling to some observers that manufacturers of motor trucks should provide so much power in their engines that they can pull not only the truck and its load, but in addition one or two trailers with a load perhaps equal to that of the truck itself. The explanation is, of course, that the manufacturers must design their trucks so as to be capable of carrying their load under the worst conditions of hills and bad roads and, if they have sufficient power for this, they have a large surplus of power under normal conditions.

One serious problem in connection with the use of trailers is that of effective braking. Not only is it necessary that the brakes be capable of holding the trucks and trailers with full load on the steepest hills that may have to be negotiated, but a quick stop should be possible in case of an emergency. Motor trucks are used to quite an extent in congested thoroughfares and the ability to make a quick emergency stop is of the highest importance. In the past the rear wheel brakes of the truck alone generally have been depended upon for stopping the whole train, but it can easily be shown that this plan is not very efficacious. The maximum braking effort possible to obtain on any pair of wheels depends upon the total weight resting on those wheels, whereas the kinetic energy which has to be absorbed by the brakes in bringing the train to a stop depends upon the total weight of the train load. In the case of a motor truck alone the weight on the brake carrying wheels is usually about two-thirds of the whole, but in the case of a train composed of a truck and two trailers

this fraction may be as low as one-quarter. The adherence of the braking wheels to the ground is then entirely inadequate to make a quick stop possible, and, moreover, the tire wear on the brake carrying wheels, due to the frequent necessity of locking these wheels is enormous.

Railroad experience has shown that, in the case of a train, it is necessary to exert braking effort on all of the units composing the train. The same practice will undoubtedly have to be followed in the case of road trains, if these trains are to be operated with safety. In the State of California, a law has been passed requiring all trailers to be fitted with brakes, and it is not at all unlikely that other states will pass similar legislation in the near future. This point was not considered in the regular motor vehicle laws of the several states as trailers were not in extensive use at the time those laws were drafted.

There are at least three different braking systems applicable to trailers. The first consists in the provision of hand brakes, which may be set either by the driver before starting to descend a steep grade or by a special brakeman who rides on the trailer. Setting the brake by the driver does not provide for emergency stops and a brakeman on the trailer is, of course, an important item of expense.

Then there is the air brake, which can be installed and operated exactly as on railroads,, and finally we have a newly developed braking system known as the drawbar operated brake. With the latter, the compression of the drawbar, when the trailers coast, applies brakes on the wheels of the trailer, the force of application being in direct proportion to the retarding force required to hold the vehicle on the grade. There is also compression on the drawbar in backing, when, of course, it is not desired normally to have the brakes on. This difficulty has been overcome by so arranging the linkage that the friction between brake drum and brake band during rearward motion will make it ineffective.

In place of the pneumatic brake, an electric brake could be used, operated from the driver's seat but, as only few trucks carry a generator, probably the electric brake would not receive as much consideration as the pneumatic type.

It will thus be seen that there are several types of brakes available for motor truck trailers and all of them no doubt will see considerable use during the next year or two. Eventually, experience may prove one to be superior in service to the others and lead to its exclusive use.

Farmers' New Viewpoint

AT the recent convention of the National Grange the national system of good roads was heartily indorsed and the membership, without dissent, approved of a plan for hard surface roads. The representatives of the Grange in Washington were instructed to work for the adoption of this objective by the Federal Government.

Under present conditions this means the indorsement of the Townsend Bill.

The remarkable thing about this movement is that this is entirely a new stand for a large group of farmers to take. Heretofore the farmer has been the opponent of hard surface roads. He was inclined to think that an earth road was good enough for him and that he did not care to build a hard surface road for his city cousins. But there have been changes in the method of paying for roads. Also there has been a very great change on the part of the farmer toward hard surface roads. He has seen that an all-year road means much to him in the marketing of his products and in finding enjoyment for himself and his family. In other words, the farmer has quit following the example of the bear and hibernating for the winter.

The Misinformed Worker

THE worker is not vicious, or a natural trouble maker. He is more likely to have a misunderstanding of conditions, was the message carried in a recent talk by a New York banker. Employers generally have come to realize that this is true and that the best way to stop discontent is to head it off. Perhaps you do not know what your workers are thinking. The banker told this story to illustrate his point that often workers were doing exactly the wrong thing to reach their desired end:

Several years ago, when I was in the government service, I received a letter one day from a Colorado Congressman, complaining that a mechanic in the Denver mint was working as a strikebreaker during his vacation. I had occasion to visit the mint later and showed the letter to the employe. He explained that he was trying to pay for a home and had not thought it was wrong to earn some money during his vacation. The "strike," he said, was a technical one, declared a year or more before, because the shop was an "open" one. Then he told me that he had worked at that shop before he entered the mint, and explained how it came to be made an "open" shop.

The shop was running upon a specialty, a small tool used in mining operations which was made upon a lathe. When he began he was green at the work, but he improved rapidly, and in a few days the foreman came to him and told him that he was killing the job. He thought the foreman meant that he was not turning out the tools as fast as he should, and he said: "I know I am green at it, but I am gaining. Last week I could make 30 a day, but yesterday I made 35 and I think I will soon make 40." "Good God!" said the foreman, "25 is the stunt!" The men, with the foreman in collusion, were deliberately restricting the output of the shop.

Now of course, those men thought they were doing something that would benefit other workingmen; what they were really doing was raising the cost of a tool that other workingmen had to buy. To whatever extent that practice pervades industry it enters into the cost of living, it's a drag upon industry and an obstacle to progress. It is economically wrong and morally wrong, and it dwarfs the ability of the workers themselves.. No man can be a full man, no man can do himself justice or come into his full powers unless he does his honest best, not merely for his employer, but for the community of which he is a part and which is his real paymaster in the end.

NEW ENGINE TYPES AT BRITISH EXHIBIT

Olympia's Showing of Post War Motorcycles Reveals Marked Development

LONDON, Nov. 24—(Special Cable.) The first British post-war motorcycle show, which opened at Olympia today, shows a marked development of the two-cylinder opposed horizontal engines and considerable gains in single cylinder, two-cycle machines.

Side cars are used very generally and they are equipped with folding top door and wide screens, and prices range up to $800.

No pressed steel frames are seen.

No radical development from war practice is seen. The machines are mostly small production types.

The American manufacturers represented are Indian, Harley Davidson, Reading, and Standard. Only one four-cylinder machine is shown.

The British makes are generally lighter than the American.

There is great interest in this show and all British makers report that they are far behind in deliveries.

October Exports Gain $35,000,000

WASHINGTON, Nov. 24—American exports in October, 1919, were valued at $632,000,000, a gain of $35,000,000 over September and of $130,000,000 over October of the previous year, according to a statement issued today by the Bureau of Foreign and Domestic Commerce, Department of Commerce. Exports for the 10 months ended with October are placed at $6,501,000,000, an increase of $1,440,000,000 as compared with the corresponding period of 1918.

October imports totaled $416,000,000, a falling off of $20,000,000 from the high mark of September, but an increase of $169,000,000 over October of last year. For the 10 months ended with October, imports amounted to $3,113,000,000, a gain of $543,000,000 over the similar period of last year. This figure for the first 10 months of the current calendar year is higher than that recorded for any previous full calendar year.

Maibohm Has Novel Car Tracing Meth[o]

SANDUSKY, O., Nov. 25—The traffic service department at the Maibohm Motors Co. plant here operates a novel system of checking the progress of its cars and tracing them to destinations.

In the simplicity of this checking plan lies the secret of its success. Two printed cards are used about the size of a postal card. The first of these is sent direct to the dealer. It gives him at a glance the factory's order number, the contents of the shipment and all other information, even the initial and number of the car. The second card goes to the freight agent at each of the division points passed on the routing. The reverse of this card carries such information as will enable the freight agent to identify the shipment. He is asked to fill in the date, hour and train number on which the shipment was forwarded from his division point to the next one. The card, with this information written on it in the agent's own hand, is dropped in the mail and becomes a part of the permanent records at the factory.

At Sandusky the progress of each shipment is kept track of by these daily records. If notice comes that a car has been forwarded from one division point and nothing is heard from the next division point the factory immediately starts its tracing machinery working. Their work is much simplified because they know that the shipment went astray somewhere between two definite points.

It is estimated by H. C. Maibohm, president of the company, that this system has paid for itself several times over in a very short time.

Studebaker Corp. Doubles Capital

NEW YORK, Nov. 25—Stockholders of the Studebaker Corp., at a special meeting, have ratified the plan to increase the authorized capitalization from $45,000,000 to $90,000,000, all of the new stock to be common.

It is announced that there will be an immediate issue of $15,000,000 to be offered to shareholders of record Nov. 29, at 105.

The report of the corporation for the nine months ending September 30, 1919, discloses net profits after interest and Federal taxes of $7,023,386, equivalent, after preferred dividend payments, to $21.53 a share earned on the common stock.

FORM PARTS COMPANY

INDIANAPOLIS, Nov. 24.—Announcement is made of the organization of the Fairfield Manufacturing Co., Lafayette, Ind., to manufacture differential and bevel gears for automobiles. The officers of the new company, all of whom are prominent in the Ross Gear & Tool Co., makers of Ross Steering Gears, are D. L. Ross, president; J. W. DeCou, vice-president and general manager; Edward A. Ross, secretary; George C. Kumming, treasurer, and David E. Ross, consulting engineer.

Organization of the Fairfield Manufacturing Co. is the result of the growth of the Ross Gear & Tool Co. A part of the Ross factory facilities have heretofore been devoted to the manufacture of the differential and bevel gears that will now be produced by the new organization. All patents, machinery, etc., for making bevel gears, formerly owned and controlled by the Ross Co., have been taken over by the Fairfield interests. The new company will take possession of the plant formerly occupied by the Lafayette Engineering Co. and will probably be in full production by Jan. 1.

DETAILS OF WILLYS-REPUBLIC DEAL TOLD

Controlling Interest Purchased by Willys-Ruggles-Baxter Combination

DETROIT, Nov. 18—Details of the purchase of control of the Republic Truck Co., Alma, Mich., and its subsidiary the Torbensen Axle Co., Cleveland, by John N. Willys, F. W. Ruggles and William J. Baxter, have been made public, following a recent meeting of the directors. At the same time it was emphasized that the Willys-Overland Co. was not concerned in the deal, nor was the purchase outright, the Willys-Ruggles-Baxter combination simply acquiring control.

The conclusion of negotiations marked the passing of C. G. Rhodes, secretary-treasurer of the Republic Truck Co., C. F. Hepburn, vice-persident and general manager of the Republic and J. O. Eaton, vice-president of the Torbensen Axle Co., whose resignations were made effective on the day of the meeting of directors. Successors to them have not been named but will be selected at a meeting of the directors scheduled the week of Nov. 23.

Complete control of the administrative policies of the Republic, the largest exclusive truck manufacturing company in the world, is vested in Ruggles, whose personality is credited largely with the success of the organization. Ruggles statement puts an effective quietus on the report that the Willys-Overland Co. had absorbed the Republic and would dominate it and another rumor that Ruggles would be eliminated and was planning the organization of a truck company in Saginaw.

There will be no change in the financial affairs of the Republic, which has 100,000 shares of common stock of no par value outstanding. The company was organized in 1913 and has put 60,000 trucks on the market, the present daily production running about 40.

FORM SEMAPHORE CO.

GREEN BAY, WIS., Nov. 24—The Semaphore Auto Signal Co. of Green Bay, Wis., has been incorporated with a capital stock of $5,000 to manufacture metal signal devices and other automotive equipment specialties.

GEMCO CO. ENLARGES

MILWAUKEE, Nov. 24—The Gemco Mfg. Co., Milwaukee, has let contracts for the construction of a 2-story factory addition, 50x150 ft., at 742-752 South Pierce street, which will greatly enlarge its capacity for producing bumpers and other automotive equipment. The concern originally was founded as the Garage Equipment Mfg. Co. Grant F. Discher is president and general manager.

SHOW MEN FAVOR HIGHER ADMISSIONS

Propose Meeting Higher Costs by Increasing Scale of Door Prices

CHICAGO, Nov. 14—Higher admission prices for motor car shows this winter are likely, according to sentiment expressed here today at a meeting of the National Association of Automobile Show Managers. When the subject of show costs came it was revealed that decorating and other expenses will be about a third higher than in other years and that some way must be found to meet the increase.

The price of show admissions has remained stationary while everything else has been going up, with the result that the managers were unanimous that the gate should be increased. In the case of shows that have charged 50 cents plus the war tax it is likely the figure will be 75 cents with war tax absorbed. This would be a net increase of about 40 per cent. In cases where the admission has been less than 50 cents the sentiment was for a corresponding percentage increase.

The association, which was formed three years age, has done much for the industry in standardizing methods and reducing show costs. It is now proposed to broaden the scope of the work, increase membership fees and go forward with some important ventures. The annual meeting will be held in this city during the Chicago show, and it is probable that at that time provision will be made for a June meeting, which time would be well enough in advance of the show season to ante-date all show plans and permit all suggestions made to be available for use the following season.

Considerable attention was given to the motor truck, and various plans were described for holding shows, tours and other affairs to stimulate interest in the motor truck business. Guy C. Hall, manager of the National Tractor Show, was admitted to membership.

FOREIGN TRADE OPPORTUNITIES

WASHINGTON, Nov. 22—The Bureau of Foreign & Domestic Commerce, Department of Commerce, has received requests for automobiles or parts agencies of business from individuals and companies in foreign countries. These are listed below. For further information address the Bureau of Foreign & Domestic Commerce and specify the Foreign Trade Opportunity number.

A firm in Spain desires to purchase and secure an agency for the sale of automobile equipment. Correspondence should be in Spanish. References. 31277

The partner of a firm in Uruguay will shortly arrive in the United States and desires to secure agencies for the sale of five and seven passenger automobiles, one at $1400 and one at $2200. Quotation should be given c. i. f. Montevideo. Correspondence may be in English. References. 31279.

An engineer in Lettland desires to secure the representation of exporters of automobiles. Correspondence may be in English. 31282.

A commercial agent from England is in the United States and desires to secure an agency for the sale of automobile accessories. References. 31285.

An American firm having a branch office in India desires to secure an agency for sale in that country of medium-priced automobiles. References. 31296.

An agency is desired by a man in Norway for the sale of a medium-priced automobile. Reference. 31301.

A firm in Canada desires to secure the sole agency for the sale of medium and low priced motor cars and trucks. Quotations should be given c. i. f. destination. Terms, cash for first order. Reference. 31314.

Publication of this issue of Automotive Industries has been delayed until Dec. 15 by conditions over which the publishers have had no control. Further issues will be forthcoming as rapidly as they can be printed.

Hartford Show in January This Year

HARTFORD, CONN., Nov. 20—Hartford dealers have decided to hold their annual automobile show the week of Jan. 17 to 24, inclusive, at the State armory on Broad Street, which is two months earlier than the exhibition is usually held.

The advanced dates were decided upon as a sales asset because experience has shown that prospects, though they may go to the New York show, always wait for the local exhibition. Therefore, the advance in date is deemed good business and the beginning of an earlier season for all makes of cars. The conduct of the show will be left to Arthur Fifoot, secretary of the dealers association and the show committee consisting of Ben F. Smith, D. A. Burnham and John D. Evans. The committee assures a much larger show than last season. Trucks and tractors will be displayed in addition to the usual line of passenger vehicles. There are a number of new agencies to be represented this season.

MAKE PNEUMATICS

AKRON, O., Nov. 24.—Announcement is made by M. E. Mason, salesmanager of the Mohawk Rubber Co., of the manufacture of a line of special pneumatic truck tires which soon will be placed on the market. Some sizes are already being made and a complete line will be produced when new factories and equipment are ready.

1920 OUTPUT SOLD AT OLYMPIA SHOW

British Attendance Records Fall—Strike Methods Curtail Production

LONDON, Nov. 25—(Special Cable.) The attendance at the Olympia motor car show exceeded 300,000, which breaks all previous records.

A number of manufacturers report that their sales at the close of the show included their entire 1920 output and in several instances the sales will include the output up to the middle of 1921 unless they are able to increase production above present expectations. These sales are on a basis of an average of $500 a car above the prices announced early this year and are subject to further advances.

There is as yet no British quantity production under way and the firms contemplating big production, like Austin and Angus Sanderson, are rapidly increasing retail prices.

The entire industry is held back by the foundry strike, which began Sept. 22, and as yet does not appear to be near settlement. Some of the factories are closed and others are working with greatly reduced forces because of a lack of castings. Half of the automotive industry workers are said to be idle.

Only six British factories are producing more than 30 cars weekly and the others fewer. Production clings to prewar methods and hand fitting still rules in the assembly chain.

There have been no deliveries of postwar models for several weeks and one often hears the charge that the manufacturers are co-operating to maintain present high prices.

An American would say that too many British makers are producing the superexpensive car in very small quantities and that they have failed to grasp production as our country understands the word. There is no offering of engines, gearsets, axles, clutches and bodies to the trade for the assembly of cars as is the practice in America.

Milwaukee to Hold Show Jan. 19-25

MILWAUKEE, Nov. 24—The Milwaukee Automobile Dealers, Inc., has selected the week of Jan. 19 to 25 as the dates for the twelfth annual Milwaukee show. It will be held in the Auditorium, occupying the main arena as well as Machinery hall in the basement, and four smaller halls on the ground floor.

James E. Van Etta, distributor of the Stutz in Wisconsin, has been appointed a member of the show committee, filling the vacancy caused by the fact that Horace P. Carter, manager of the Milwaukee Buick branch, has been promoted to the Chicago branch. L. D. Frint, Oldsmobile distributor, is chairman of the show committee.

DESIGN X-RAY FOR TESTING WELDING

Development by London Company Takes Radiographs Through Two-Inch Plates

LONDON, Nov. 14—(Special Correspondence.) Among the new things at the Olympia Show is a new X-Ray apparatus with Coolidge tube for radio-graphing metals. It has been developed for its present purpose by the Watson & Sons, Ltd., optical and scientific instrument makers.

Its immediate use by the firm exhibiting it is for verifying oxy-acetylene welds, in which a big business has been developed during the war. Sample radiographs were shown taken through 2 in. steel pieces, and defects (where present) were clearly denoted by light lines corresponding to the shape and position of the defective structure.

The Coolidge tube and carrier are carried on a universal adjustable slide, supported at one end on a cabinet about 4 ft. high. A step-up transformer is incorporated in the cabinet, and transforms the current to about 100,000 volts. It costs about $1,750.

(The Coolidge tube is an American instrument and this development of it should be valuable in the testing of metals.)

MANUFACTURERS' CENSUS

WASHINGTON, Nov. 20—Special effort is being put forth to make the manufacturers section of the approaching fourteenth decennial census the most complete and comprehensive inventory of the nation's manufacturing establishments ever taken, according to officials of the Bureau of the Census, who have this work in charge.

The schedules which will be used in tabulating the information about the country's industrial resources have already been prepared and printed. These schedules will be mailed to every manufacturing establishment in the United States during the month of December so that factory owners and managers can familiarize themselves in advance with the questions to be answered when the records of the past year's business have been compiled. The questions relate to the calendar year 1919.

The inquiries relating to manufactures, as specified by the Act of Congrss providing for the Census, include the name and location of each manufacturing establishment; character of organization, whether individual, corporate or other form; character of business or kind of goods manufactured; amount of capital actually invested; number of proprietors, firm members, co-partners and officers, together with the amount of their salaries; number of employes and amount of their wages; quality and cost of materials used in each establishment; quantity of value of products; principal miscellaneous expenses; time in operation during the year character and quantity of power used; and character and number of machines employed.

Census Bureau officials emphasize the fact that all information gathered by the census is strictly confidential, made so by Act of Congress, and is for general statistical purposes only. The same is true of the censuses of population, agriculture, mines and quarries, oil and gas wells and forestry and forest products.

Many startling figures are expected to be shown by the approaching compilation inasmuch as the industries of the country were for the most part in a subnormal condition in 1914, the year the last manufacturers census was taken.

Speakers Advocate Pneumatic Tires

NEW YORK, Nov. 21—The superiority of pneumatically tired trucks in all phases of truck operation was explained by John Tracy, of the National Truck Sales Managers' Association and A. R. Kroh, of the Goodyear company, to more than a score of members of the Motor Truck Association of America, in Reisenweber's last night.

Moving pictures of the tour made by a fleet of trucks in the middle west recently were shown. The story of the trip was told and comparisons were made between the performances of pneumatically and solid tired vehicles.

It was claimed that in this trip particularly the pneumatically equipped trucks outdistanced those equipped with solids under all of the trying conditions imposed, and that these trucks, at the end of the tour, were in much better mechanical condition than those on solid treads.

Some of the pictures showed the pneumatically equipped trucks pushing through mud so deep the axles pushed it ahead in the manner of a plow. Other trucks were shown climbing 15 percent. grades in mud, and speeding along on rough roads and slippery thoroughfares.

The pictures and talks were preceded by an informal dinner.

Lay Cornerstone of New Willys-Lee Unit

DETROIT, Nov. 24—Elaborate ceremonies marked the laying of the cornerstone of the first of the new units of the Wills-Lee automobile plant at Marysville last week. The occasion was made a holiday and all of the employes of the company participated. C. Harold Wills and John R. Lee, who will head the new concern, announced on the occasion of the celebration that the name of the company, the official personnel and the name of the car to be put on the market, will be made public soon after Dec. 1.

Foundations for the various units of the new factory have been completed and work on them will be rushed. Meanwhile the finishing touches are being added to the new car, which, persons connected with the organization declare will compare favorably in design and finish with the most expensive cars now on the market.

The little village of Marysville, which in the timber days was the home of about 150 persons, rapidly is being developed into a full-fledged city, with 22,000 building lots laid out on the 4,600 acres included in the corporate limits. Sixty-two modern and well appointed homes are being erected for employes of the company with community houses to accommodate 400 men, built in a quadrangle, near the factory site. The streets of the city have been laid out and named, those running north and south being named for the states, those east and west by numbers and boulevards here and there having been given the names of American heroes.

KEMPSMITH CO. GROWS

MILWAUKEE, Nov. 24—The Kempsmith Mfg. Co., Milwaukee, a large manufacturer of milling machines and other machine tools, has increased its capital stock from $400,000 to $600,000. The plant recently has been materially enlarged. Paul E. Thomas is president and general manager.

Germany Using Her War Wagons

This photograph shows a converted tractor-truck used by the German Army during the war, being used by one of the municipal departments of Berlin. The vehicle is heavy, cumbersome and slow-moving, but performs its required work with completeness truly German.

ARMY TRUCKS UNDER HAMMER IN FRANCE

Automobile Parks Equipped by Motor Transport Corps Huge Auction Grounds

PARIS, Oct. 29—(Special Correspondence.) All those automobile trucks which were the pride of the A. E. F. in 1918 are coming under the hammer, and those automobile parks erected and equipped by the Motor Transport Corps have now become huge auction grounds. During the coming month there will be a sale at Haussimont, on the Marne, when 125 Nash Quads will go into civilian service. At St. Quen, just outside Paris, 102 passenger cars, comprising Dodge, Packard, Winton, and Cadillac, are to come under the hammer. At St. Nazaire there are for sale 18 trailers and 72 trucks from the Riker, Packard, G. M. C., Garford, and A. S. factories. At the same time there will be disposed of 21 Fords and Dodges and a number of motorcycles.

At Brest the lot consists of 11 trailers, 69 trucks comprising U. S. A., A. S., F. W. D., Nash Quad and Packard, together with 37 Ford, Dodge, and G. M. C. light trucks, and 19 Cadillacs, Wintons, Fords and Dodge passenger cars.

At Verneuil, the finest reconstruction park ever erected in France, there are being sold 91 trucks comprising F. W. D., Garford, G. M. C., Kelly, Mack, Nash-Quad, and A. S., together with 23 Ford and G. M. C. light trucks and 16 Ford, National and Cole passenger cars.

St. Nazaire offers to the purchaser 4 Holt Caterpillars, 4 trailers, 55 Mack, Pierce-Arrow, U. S. A., Velie, and A. S. trucks, also 60 Ford and G. M. C. light trucks, 22 Ford and Dodge passenger cars, and 30 motorcycles.

At Bourg, near Langres, there can be purchased 4 tractors, 15 trailers, 53 Liberty, Packard, F. W. D., Riker, and Mack trucks, 37 Dodge, Fiat, Ford, and G. M. C. light trucks, and 17 Dodge, Winton and National passenger cars.

Le Mans offers 40 trucks, mostly Pierce Arrows, 20 G. M. C. and Ford light trucks, the same number of Dodge and Ford passenger cars, and an equal number of Indian motorcycles.

Romorantin, once the biggest air service depot in France, has a big and a varied lot for sale. They comprise a Holt caterpillar, 19 trailers, 61 Garford, Riker, G. M. C., and Pierce-Arrow trucks, 28 Air Service touring cars built by Packard, Winton, Hudson, Peugeot, Delage, Ford, Studebaker, and others, 14 Indian and Harley-Davidson motorcycles, a batch of all kinds of engines, bodies, etc., and a few stacks of tires.

All these sales are made direct by the French government, purchasers taking delivery of the machines without any guarantee as to their condition, and without having to pay import duty. There is no guarantee that spares will be available, and in many cases the men who get the trucks and touring cars do not get the spares which ought to go with them. In addition to these army sales the Red Cross and the Y. M. C. A. are getting rid of their last vehicles. These are generally sold by private treaty, and as they are not government property, purchasers have to pay duty on them. In the case of passenger cars this amounts to 70 per cent of the value.

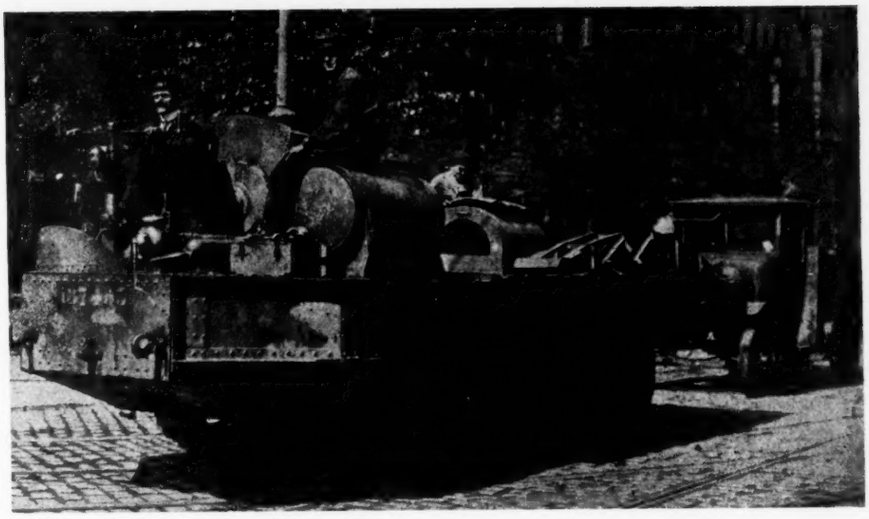


Photo by International.

Shorn of its war fittings, this German War Tractor is shown pulling a heavy load through Berlin's streets. The home of the "War Lord" has not get become accustomed to the adaption, as is shown by the youngsters escorting the lumbering monster.

PIERCE TESTS READY

BUFFALO, N. Y., Nov. 19—The Pierce Arrow Motor Car Co. has completed the installation of an extensive electric test system for its passenger-car and motor-truck engines. The installation includes a large number of electric block test stands for lapping-in and "firing" and a set of five individual silent rooms, each containing an electric cradle dynamometer, where the finish tests are run. By the method of testing used a large amount of electrical energy will be saved for utilization in the shop system. The whole electric equipment, including rotary converter and electric hoists, was built and installed by the Sprague Electric Works.

EMPLOYEE'S RISKS

CHICAGO, Nov. 24—The National Safety Council in its issue of Nov. 17 notes that the Ford Motor Co. is perhaps the first to work out a practical system of grouping its employees at street car stops and training them to enter the cars in a systematic and orderly manner. Rates of loading are greatly increased, it says, and boarding accidents are reduced to a minimum. This system, together with the staggered hour method of dismissing employees at the end of a day's work, makes it possible for the railway company to handle 20,000 employees in two hours without interference perceptibly with its normal schedule.

THREATEN SECESSION OVER ROAD DISPUTE

Northern Ontario to Form Separate Province Unless Demands Are Placated

TORONTO, Nov. 22—Northern Ontario has threatened to secede from the Province of Ontario and form a separate province unless the rich mineral, timber and agricultural hinterland in the northern section is opened up immediately with good roads.

Mayors and representatives of practically all the northern towns, cities and districts are signatories to an ultimatum recently delivered. The press of the province is urging the government to meet demands of the great northern section. It is especially urged that work be started at once on the proposed road across the north shore of Lake Superior from Sault Ste Marie to Fort William and on the proposed Fort William to Winnipeg highway.

With the completion of these two roads the last two considerable links in the trans-Canada Victory Highway will be forged leaving a gap of but a few miles in the Rockies where during and preceding the war the Federal Government of Canada has constructed a 420 mile highway, second to none in the world in scenic grandeur.

HIGHWAY ASSOCIATION TO MEET

ALEXANDRIA, LA., Nov. 24—Louisiana chapter of the Jefferson Highway Association, which is charged with the duty of arousing and maintaining interest in this road throughout Louisiana, will hold its annual convention here Dec. 18. At this meeting New Orleans will elect two civic directors who will become members of the national board of directors. Each parish with a membership of 200 is entitled to elect a civic director. It is expected that about 100 delegates will attend this convention.

INCLUDE TRAILER PROVISIONS IN BILL

National Organizations Redraft Measure for Uniformity of Traffic Laws

WASHINGTON, Nov. 17—At a meeting held here last week at the headquarters of the Federal Highway Council it was decided to incorporate the recommendations of the Trailer Manufacturers Association of America in the uniform traffic bill which has been in process of formulation for more than a year.

There has long been widespread demand for nation-wide uniformity in motor vehicle laws by motor truck owners whose business requires them to operate in several adjoining states and also by automobile users who travel extensively by motor car. The inconvenience and absurdity of having different regulations in neighboring states is recognized by state authorities, who have displayed keen interest in the forthcoming draft of a measure which is designed to make such regulations uniform throughout the country.

Trailers are such a recent development in highway transportation that very few states license them or have any regulations covering their operation. Within the last year or two Massachusetts, Connecticut, Pennsylvania, Indiana, Michigan, Illinois, Wisconsin, Texas and California have enacted some trailer legislation but it was evident that the legislators were unfamiliar with the types of trailers in service, the ways in which they are used and the probable future development along this line.

It was deemed desirable by the trailer manufacturers, for these reasons, to offer constructive suggestions for legislation that would insure protection of improved highways and safety to users thereof without operating to retard the development of a new and economical means of transportation.

The recommendations, as approved at the meeting last week, provide for registration of trailers and semi-trailers, fix annual fees at 15 cents per 100 lbs. gross weight of trailer, body and rated load capacity on pneumatic tires, 25 cents on solid rubber tires and 35 cents on iron or steel tires.

They require one number plate on the rear end, limit weight on any one axle to 22,400 lbs. weight per inch width of tire to 800 lbs., and the maximum length of trailer trains, including towing vehicle, to 85 ft.

The provisions call for use of a safety chain to prevent a trailer breaking away from the towing vehicle and a white light to be carried at the front of each trailer at night and a red light at the rear end of the last trailer.

They provide also that the weight of the trailer and its carrying capacity must be shown on the side, and authorize highway authorities, at their discretion, to issue special permits for the operation of trailers exceeding weights and dimensions fixed in the bill.

National organizations represented at the meeting were the Federal Highway Council, Highway Industries Association, National Automobile Chamber of Commerce, Motor and Accessory Manufacturers Association, American Automobile Association, Trailer Manufacturers Association and National Automobile Dealers Association.

The uniform traffic bill is now being redrafted to include the trailer provisions and will be submitted for final approval of these associations and to the Association of State Highway Officials. It will then be printed and offered for introduction in the twelve states whose legislatures meet next January and later to others.

Case Adds Thresher to Implement Line

RACINE, WIS., Nov. 24—Announcement is made by the J. I. Case Plow Works Co. that beginning at once they will add to their line a threshing machine for the farmer's individual use, known as the Wallis Threshing Machine. The new implement will be made to Case specifications by the Sawyer-Massey Co., of Hamilton, Ont.

The machine will be marketed in one size, the 24-40. It is further announced the selection of Sawyer-Massey machines was made by the Case company after two years of experimenting and observation. First displays of the thresher will be in December.

Canada May Import Bees by Airplane

TORONTO, Nov. 24—The Aero Club of Canada has been asked to assist in a very special stroke of business. D. Brunne, of the Brunne Apiaries, near New Liskeard, is seeking to arrange through the Aero Club for airplanes to bring him an importation of bees from the Southern States.

It is expected that a large number of bees will be imported into Canada for next year and the Canadian breeders do not want to take chances of getting a strain which might weaken during the winter months. So the desire is that the bees should be imported at the right moment next spring and without an hour loss of time. This is where the speed of the airplane is to be turned to account. It is probable that the first cargo of bees to be carried by airplane will be carried by Canadian airmen for Canadian beemen. It is proposed also that these flights will be used to test the practicability of delivering bee breeders supply by air.

ASSOCIATION STARTS BUREAU

MILWAUKEE, Nov. 24—The growth of automobile industries in Milwaukee and immediate vicinity has induced the Milwaukee Automobile Dealers, Inc., to expand its activities to embrace a well-organized employment bureau, serving the service stations and repair shops conducted by its members. The new bureau is under the direction of Bart J. Ruddle, executive secretary and manager of the dealers' association.

TROLLEYS TO QUIT UNLESS JITNEYS GO

Bay State Railway Company Serve Notice On Officials of Three Cities

BOSTON, Nov. 22—An ultimatum has been served upon a number of cities and towns in Eastern Massachusetts notifying the governing officials that they must take their choice now between electric street railway service or jitneys. The Eastern Massachusetts Street Railway, which serves all the territory outside greater Boston, has delivered the mandate to the city and town fathers.

Dec. 1 has been set to accept the ultimatum. The jitneys are not asked to be turned off onto side streets. The license of every one of these vehicles must be revoked, thereby putting out of business hundreds of such vehicles.

Already the mandate was carried out in some places and the street car lines were discontinued so that the residents found that it was not merely a threat, but a reality. The Public Service Commission was asked to bar competition, but it found that it could not do so as it was up to the city and town authorities. When the request was turned down the railroad officials then got busy and made their decision.

As the Eastern Massachusetts Street Railway is being operated by public trustees appointed by the legislature, making them state authorities practically, they have the power to do as they please, and the city and town authorities cannot override them.

Three of the big cities have been ordered to discontinue the jitneys, Brockton, Lynn and Lawrence, the two former big shoe cities and the latter a big mill city. There are other cities on the list, too. People who have been using the jitneys will have to make their choice, for the city officials are undecided whether or not to cut out the jitneys. The jitney people are making a fight now, and they plan to organize. The motor truck dealers who have been selling the new type of omnibus in some of these cities are also up in arms over the warfare, and they are going to try to do something.

In Boston for the past three or four months the owners of omnibuses who have been trying to get licenses to operate have been blocked by the city council, which requires $25,000 bonds and will not accept anything except equivalent of cash, thereby tying up six or seven companies with some 30 busses while the people are paying a 10-cent fare, the highest in the country for street railway service.

In the cities where the Eastern Massachusetts Street Railway operates the fares are 10 cents and the jitneys have been running for 5 cents. But the public trustees say they cannot make the roads pay with jitney competition and so jitneys or street railways must go as both cannot survive.

HAZLETON SETS SHOW

HAZLETON, PA., Nov. 22—Hazleton will have an automobile show in January following the exhibits in large nearby cities. The show will be the first held here and will be under direction of the Chamber of Commerce.

LA GUARDIA PROPOSES AIR APPROPRIATION

No Definite Models Named By Newport Congressman In New Bill

WASHINGTON, Nov. 20—A bill has been introduced into the House of Representatives by Congressman La-Guardia which provides appropriations for the purchase of airplanes and air plane engines similar to the bill announced last week, which authorized the purchase of 200 Martin bombing planes, 600 Hispano-Suiza engines, 50 observation planes and 140 training planes, except that in the new bill no definite models are named and it is not stipulated that Martin planes for example, must be purchased for the bombing planes.

The bill provides for prompt allocation of orders so that it will "foster and promote the aviation industry of the United States." It also includes an appropriation of $126,000 for ten pursuit monoplanes and $15,750 for two and one-half units of spare parts. None of the money appropriated by the bill is to be used for the purchase of Liberty engines and the types of planes and engines purchased are to be selected by the Secretary of War and the Director of Air Service, in accordance with the recommendations of a board of flying officers not more than seven in number, and of whom not less than five have had overseas service in contact with the enemy.

The Secretary of War is authorized to negotiate directly with manufacturers and is not required to advertise for sealed bids.

Below is a list of the planes and engines and appropriations.

200	multi-engine bombing planes, exclusive of engines	$ 5,000.000
50	units of spare parts for bombing planes	625,000
50	observation planes, exclusive of engines	725,000
12½	units of spare parts for observation planes	90,625
100	pursuit biplanes exclusive of engines	1,100,000
25	units of spare parts for pursuit biplanes	137,500
10	pursuit monoplanes, exclusive of engines	126,000
2½	units of spare parts for monoplanes	15,750
140	training planes, exclusive of engines	1,260,000
70	units of spare parts for training planes	315,000
600	airplane engines	4,200,000
300	units of spare parts for airplane engines	1,050,000
	Total	$14,644,875

British Set July for 1920 Aero Exhibit

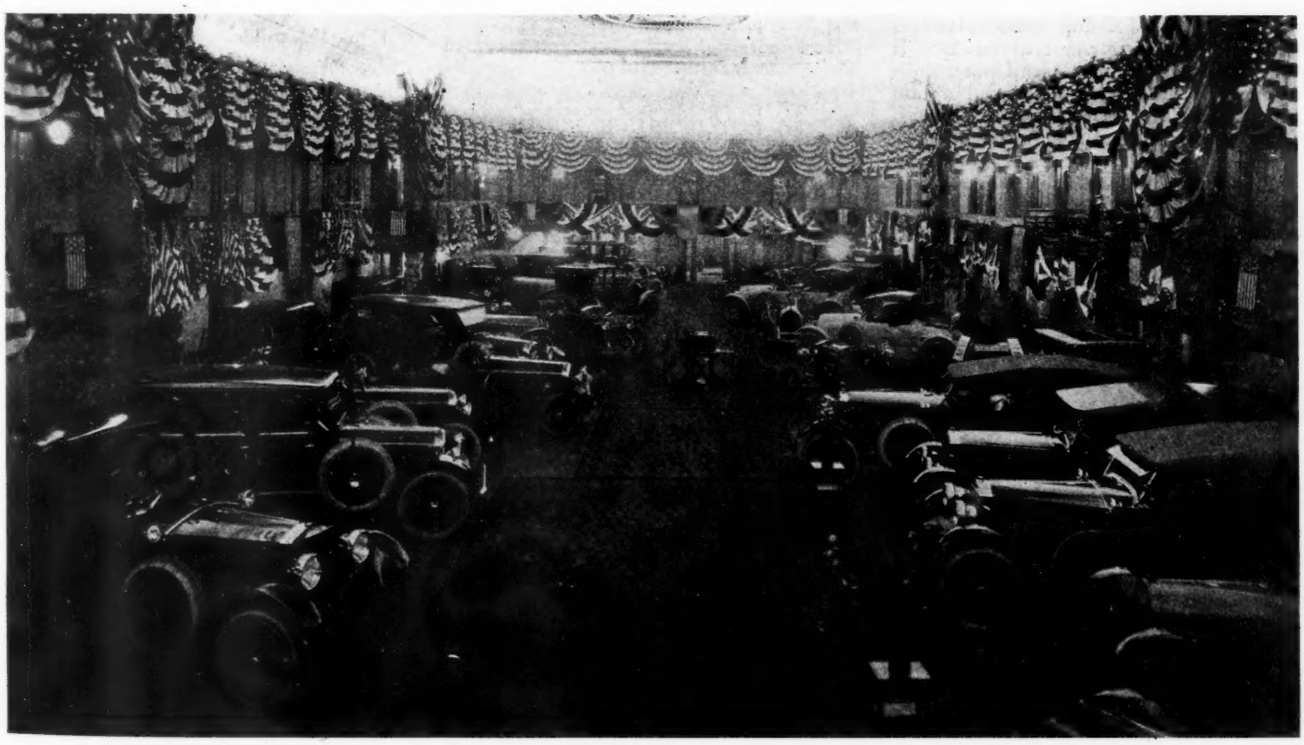
LONDON, Nov. 1—(Special Correspondence.) Arrangements have now been made to hold an International Aero Exhibition at Olympia in July next. Before the war a successful series of aero exhibitions was held by the Society of Motor Manufacturers & Traders at Olympia, the first one since 1909.

Owing to the growth of the British aircraft industry during the war, the aircraft firms have formed a separate body, the Society of British Aircraft Constructors, which comprises in its membership practically every manufacturer of aircraft, aircraft engines and their component parts, equipment and materials; this body has entered into an agreement with the Society of Motor Manufacturers and Traders under which the pre-war aero exhibitions will be continued under the joint management of the two societies.

The arrangements provide for the setting up of a joint committee to promote aero exhibitions in the United Kingdom and the use of the exhibition organization maintained by the Society of Motor Manufacturers for the carrying out of its annual motor and other exhibitions.

Frank B. Hanford, formerly motor designer with Frezo Motors Corp., New Haven, Conn., is now located with the Wills-Lee interests, in a like position.

Aristocrats of the Road at the Automobile Salon



Opening with the Horse Show and the Opera Season this exposition of quality cars at the Hotel Commodore, New York, vied with those classic events for the patronage of the "Smart Set" during the week of Nov. 17.

LONDON STEAM BUS SERVICE SUSPENDED

Increasing Cost of Operation Causes Discontinuance of Kerosene Burning Line

LONDON, Nov. 14—(Special Correspondence.) After a ten years' history with seeming increasingly satisfactory results from the mechanical aspect, it came as a surprise this week that the several scores of National steam buses were withdrawn from London traffic, on the ground of increasing loss in operation.

The surprise is greater because of its being so persistently stated that these kerosene-burning steam vehicles were so much cheaper in fuel cost and immunity from repairs compared with their gasoline rivals, and the claim certainly was supported by the balance sheets issued until before the war.

The system used is that patented and the life's work of Thomas Clarkson of Chelmsford, Essex, who, by a coincidence, is this year's president of the Institution of Automobile Engineers. The earliest inkling of the present situation was given at last year's annual meeting of the National Steam Car's shareholders, when a big loss on operation was shown. The management was reorganized and Clarkson was set free to devote his attention solely to the mechanical side of the business.

A short time before that event he had demonstrated to a group of press men an improved form of coke-burning steam plant, capable of being substituted for the gasoline power plant of trucks. It had the Clarkson patent semi-water tube boiler with self-coking feed, and a tandem pair-cylinders vee-type non-reversing engine, the idea being to use the reverse gear of the usual transmission for braking the vehicle. The usual clutch was retained, so that virtually the plant consisted of a steam on an engine with the necessary feed pumps. It was anticipated that this set would ultimately replace the earlier kerosene fuel plant in the buses.

Kerosene is quoted about 20 cents a gallon (British), and as against gasoline at 60 cents, suggests too big a discrepancy to place to the score of loss on the fuel cost. Probably labor, which is at least 100 to 120 per cent higher, has had much to do with the decision not to face a further loss. And it should also be noted that a considerable number of the buses were due to be scrapped. While in fair condition these National steam buses were much favored, their only drawback being the vapor heat felt by inside passengers. They were practically without smell, and their starting was quite free from the jerks that are inseparable from the gasoline layout. The latter, however, has been so much improved in the meantime that bad driving is chiefly responsible for any present clutch and gear changing trouble. The National company's upkeep resources probably were not commensurate with the corresponding task of improving the steam buses to compete with the gasoline buses of the well known London General Omnibus Co.

Meanwhile the several hundreds of workers thrown out of work by this stoppage are asking the government to restart them, presumably as a charge on the public rates. This appeal is not likely to be granted and the lines are not expected to reopen.

Airplane Service Maintains Schedule

WASHINGTON, Nov. 22—The Air Mail Service for the month of September flew 56,744 miles carrying the mail with only fourteen temporary interruptions due to forced landings on account of motor trouble or weather conditions. Out of a possible 174 trips attempted, 172 were completed. On the routes from New York to Washington and from Cleveland to Chicago a performance of 100 per cent was scored, and 97½ per cent over the mountainous route from New York to Cleveland.

A total of 56,668 lbs. of mail, approximately 2,226,720 letters, was carried at a cost of $22,648.39 including 33⅓ per cent depreciation and 6 per cent on the investment.

The New England mail, too late for New York train connections, was advanced by mail plane every day for afternoon delivery in Washington without single failure, the latest arrival of plane was 1:20 p. m. Likewise Southern mail, failing of train connection at Washington, was advanced every day for afternoon delivery in New York without a single failure, the latest arrival was 1:49 p. m.

No fatalities or serious accidents occurred during the month.

TO BUILD TRUCK BODIES

Muskegon, Mich., Nov. 17.—The Fitz John-Erwin Manufacturing Co. has just been incorporated with a capital stock of $100,000 for manufacture of truck bodies and cabs. These will be sold direct to leading truck manufacturers. Because of the prominence of several stockholders in the automotive field, contracts have already been secured from several prominent truck manufacturers.

The Fitz John-Irwin Manufacturing Co. is at Muskegon, and the initial building comprises 25,000 square feet of manufacturing space. The present factory is situated on an eight-acre tract of ground which permits ready expansion for future growth.

H. A. Fitz John is president and general manager; W. C. Powell, vice-president; L. B. Erwin, secretary, and T. H. Hume, treasurer. Fitz John has been associated with the industry for many years. His experience with the Hudson Motor Car Co. and as production manager of the Continental Motors Corp. has fitted him forf actory production which already is well under way.

During the war, Fitz John was director of purchases and in charge of production at the Dayton Wright Airplane Co., Dayton. His associates are men of long business experience.

DUESENBERG RACERS CLAIM NEW RECORDS

Lewis Drives 100 Miles in 53:25.40. Murphy 300 in 3:15:44

NEW YORK, Nov. 18—Driving Duesenberg cars in non-competitive speed trials under A. A. A. observation at Sheepshead Bay today, Dave Lewis and James Murphy set new marks for 100 miles and 300 miles respectively, which have been referred to the Contest Board and may be declared records.

Lewis covered the 100 mile course in 53 min. 25.4 sec., averaging 112.3 miles an hour. This was done in an overbored 300 in. car which is placed in the 301-450 cu. in. piston displacement class.

Murphy drove a new 183 in. Duesenberg, showing 98 miles for the first hour, in which no stops were made. During the second hour the car ran out of gas on the back stretch and Murphy lost more than eight minutes, including a stop of nearly five minutes. He traveled almost 92 miles in the second hour, and slightly over 90 miles in the third hour. The 300 mi. was covered in 3 hr. 15 min. 44 sec.

The official time scores, which have been referred to the A. A. A. contest board, are:

Dave Lewis
Duesenberg
303.5 cu. in. displacement

Miles	Time
10	5:14.00
20	10:31.40
50	26:30.60
100	53:25.40

1 hr. 111 miles.

J. A. Murphy
Duesenberg
183 cu. in. displacement

Miles	Time
10	6:14.60
20	12:26.40
50	30:57.40
100	1:01:24.20
150	1:32:12.60
200	2:12:08.80
250	2:42:59.40
300	3:15:44.00

1 hr. 98 miles.
2 hr. 182 miles.
3 hr. 276 miles.

ISSUE AIR YEARBOOK

NEW YORK, Nov. 20—The process of the evolution of airplanes from prewar models, through the war, and the evolution that is now in progress to meet the demands for commercial and peacetime activities, are shown in the Aircraft Yearbook for 1920, which is being compiled by the American Aircraft Manufacturers Association.

It is expected the yearbooks will be off the presses about the first of the year, and hundreds of demands for them from manufacturers, technical societies, libraries, foreign exporters, trade engineers, and foreign and American transportation companies have been received.

HALIFAX-VANCOUVER HIGHWAY ADVOCATED

Project to Link Oceans with Great Transcontinental Road Enthusiastically Supported

NEW YORK, Nov. 22—The American Chamber of Commerce in Canada has announced that the dominion is to have a "Main Street," similar to the Lincoln Highway in the United States.

The dominion and provincial governments are keenly interested in the movement, and committees have been formed in Toronto and Ottawa for the furtherance of the project to link the oceans by roadway.

Branches of the organization have sprung up in all of the provinces that will be traversed. The good road idea is taking hold strongly throughout the dominion and is being urged and aided by the government.

Definite plans have been formed for the organization of an association along the same lines as the Lincoln Highway Association, pledged to construct a great transcontinental highway between Halifax and Vancouver.

A. F. Bement, vice-president of the organization in the United States, has been invited to address the Ontario Motor League in the near future and tell the steps taken and the progress made in the construction of the Lincoln Highway.

$25,000 Purse for Tacoma Sweepstakes

TACOMA, WASH., Nov. 21—Ten of America's foremost racing drivers will be invited to enter the 1920 track events at the Tacoma Speedway, to be held on July 4. W. C. Baldwin, president of the speedway association, says he has already received entry assurances from Ralph Mulford, Louis Chevrolet and Ralph Durant. The ten American drivers will all be picked men and to make competition keener two foreign cars with foreign drivers will also be entered.

The association will offer $25,000 in prizes for the 1920 events, exceeding the 1919 purse by $10,000, and making the largest purse ever offered on the Pacific Coast for either road or track events. For the past three years the number of drivers has been held to five, but in 1920 this will be doubled. A further departure will be in the distance of races. Formerly the longest race was 75 miles. In 1920 it will be 200 miles. Details of the program have been submitted to the American Automobile Association for consideration.

EISEMANN GETS CONTRACTS

NEW YORK, Nov. 24.—The Eisemann Magneto Corp. announces a contract for high-tension magneto equipment for the "Argonne 4," a new special roadster built by the Jersey City Machine Co., under the supervision of Charles A. Singer.

The company also announces renewal of contracts for magnetos with the Winther Motor Truck Co., Dart Truck & Tractor Corp., and Toro Motor Co. It has also received contracts for magnetos for the "Dixie Flyer," the passenger car built by the Kentucky Wagon Co., Louisville.

INCORPORATE TOOL CO.

The Automotive Machine & Tool Co., Janesville, Wis., has been incorporated with a capital stock of $6,000 by B. W. Fitch, D. S. Harder and J. R. Calhoun to manufacture and deal in machine tools, machinery and appliances for the automotive industry.

Ship 30 Tractors to Far East Users

NEW YORK, Nov. 26—Thirty Bates "steel-mule" crawling grip tractors have been shipped by the Automotive Products Corp. to Indo-China, where they will be used in opening up new areas for cultivation of rice, sugar, cotton, tobacco and other products.

The tractors were specially prepared for shipment so they could be driven under their own power into the interior on arrival. They will burn kerosene owing to scarcity of gasoline in the territory in which they will operate.

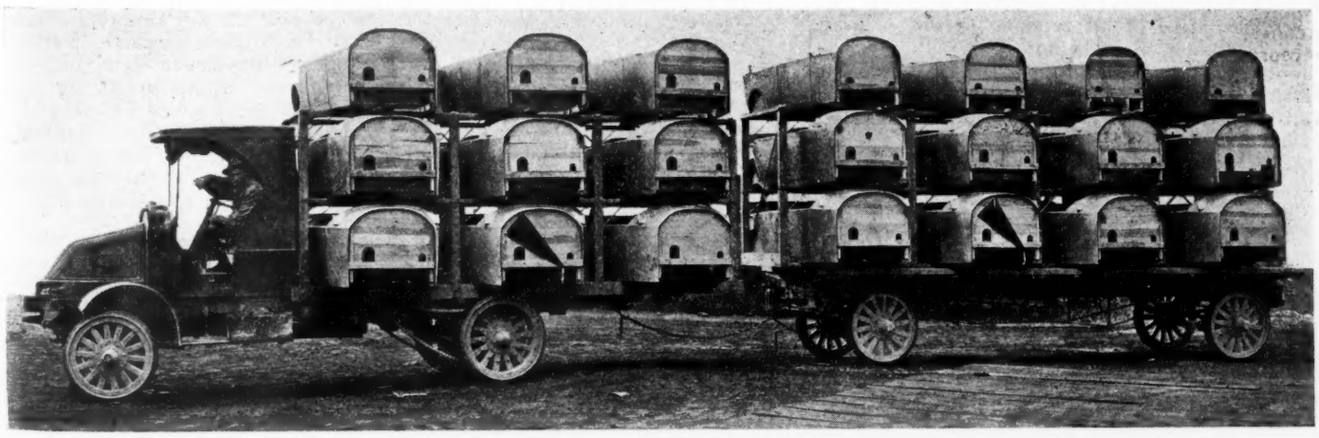
LIST DEALERS ABROAD

WASHINGTON, Nov. 25—A list of the American automobile companies represented in Great Britain has been prepared by Acting Commercial Attache H. F. Grady, London, in conjunction with the American Chamber of Commerce. This list may be obtained from the Bureau of Foreign & Domestic Commerce or its district and cooperative offices. Refer to file No. 21119.

FRENCH GAS AMPLE

PARIS, Oct. 29—(Special Correspondence.) Stocks of gasoline and kerosene in France are adequate at the present time, according to an official statement issued by the gasoline commission. Present stocks consist of 120,000 tons of kerosene, equal to four months' average consumption; 100,000 tons of gasoline, and 60,000 tons of heavy mineral oils. If there is a shortage in certain districts this is due to poor distribution. Where the railroad service is not satisfactory, arrangements are being made for tank distribution by automobile. The ports in which stocks are maintained are Havre, Rouen, Dunkirk, La Pallice, Bordeaux, Balarue, Cette and Marseille.

Trailer Used to Relieve Freight Congestion



The Westcott Motor Co. was having trouble getting automobile bodies delivered from the body factory at Muncie, Ind., to the Wescott factory at Springfield, O. So they appealed to the J. S. Wagner Transfer & Storage Co. The latter company had, as part of the equipment, a three-ton trailer. This was used to haul the bodies with the above results. A load is twenty-one of the Light Six bodies and they are hauled 100 miles. The trailer makes the round trip in 20 hr. This method of shipping is a trifle more expensive than railroad shipments but no delays were experienced. In bad weather the load was covered with canvas

COMMITTEE TO FRAME EUROPEAN CREDITS

Bankers Named by U.S. Chamber of Commerce to Study Credit

WASHINGTON, Nov. 23—Organization of the National Committee on European Finance, to study definite plans for supplying the necessary long time credit for Europe's purchases in the United States, was announced today. This committee is appointed by the Chamber of Commerce of the United States following the recommendation of the Committee on Credit and Finance of the recent International Trade Conference at Atlantic City. At that conference representatives of American business, industry and banking conferred with unofficial representatives from England, France, Belgium and Italy on the commodity and credit needs of their respective countries.

Organization of this committee is believed to be a step toward the solution of the most important peace-time financial problems which have ever confronted a nation. The task before the committee is to devise ways and means for speeding up a return to normal in the trade relationships between the United States and Europe. Leading business men believe that only by the full cooperation of the investing public and all the commercial, industrial and financial interests throughout the entire United States can this task be performed.

The chairman of the new body is Harry A. Wheeler, vice-president of the Union Trust Company of Chicago; Wheeler was the first president of the Chamber of Commerce of the United States. The chairman of the Executive Committee is James S. Alexander, president of the National Bank of Commerce in New York. The membership has been drawn from among men of experience in all the various lines of business activity and important affairs of the nation and is representative of all sections of the country, among them being: Henry P. Davison, Homer L. Ferguson, Myron T. Herrick, Charles E. Hughes, Alfred E. Marling, William Fellowes Morgan, William C. Redfield, Charles H. Sabin, Charles M. Schwab and former president William H. Taft.

S. A. E. Standards Ready for Adoption

NEW YORK, Nov. 20—Meetings are being held almost daily by the various divisions of the Standards Committee of the Society of Automotive Engineers and may reports are in form to be presented to the committee for final action.

At a recent meeting of the Ball and Roller Bearing Division the corner radii values specified in the S. A. E. tables were voted to be the minimum value. Tolerances were fixed for extra small type annular ball bearings and on separable type bearings. Nothing was done on airplane bearings, as this was believed to be a matter of internal design rather than dimensional standardization.

At the meeting of the Transmission Division, held in Detroit Nov. 11, it was voted to take up the matter of speedometer drives from the transmission with the speedometer makers with a view toward standardization.

The Shaft Fittings Division, at a meeting in New York on Nov. 19, approved a proposed standard 16 spline fitting for presentation to the Standards Committee.

Mower Attachment Made for Tractors

DETROIT, Nov. 24—A mower attachment for the Fordson tractor is the latest innovation in farm machinery which has stood all tests and bids fair to take its place along with the tractor in the favor of farmers. It uses the power of the tractor from the pulley shaft, a bevel gear taking the place of the pulley when the mower is attached. The entire outfit weighs less than one-third the horse drawn mower and together with the tractor is a strictly one-man outfit. The knives are forward of the driver's seat making it impossible for the driver to be hurt should he fall from the tractor. The mower is being put out by the Otwell Tractor Equipment Company.

New York Registers 90,361 New Cars

NEW YORK, Nov. 22—Motor vehicles in New York state have increased 90,361 since Nov. 1, 1918, according to figures compiled in state registry offices. The bulk of the increase is in passenger cars, 71,187 being the added number, and trucks are second with an added list of 15,937. Only one class of motor vehicles shows a falling off, motorcycles decreasing 386 in popularity.

A comparative table of the two years shows:

	1918	1919
Passenger	362,175	433,362
Omnibus	17,711	21,135
Trucks	73,797	89,734
Trailers	2,150	2,349
Motorcycles	28,356	27,790

In the year 378 new dealers entered the field and 30,902 new chauffeurs were licensed. New York City district had a total registration on Nov. 1 of 232,808 as compared with 191,240 a year ago. New passenger cars totalled 32,890 of this increase in the city district, trucks, 6,053; busses, 2,287, and 89 new trailers. New dealers in the city numbered 258.

"OLD GUARD" BANQUETS

AKRON, O., Nov. 22—The "Old Guard" of the Goodyear Tire & Rubber Co. were entertained at dinner Wednesday at the City Club by P. W. Litchfield, factory manager. The dinner is an annual affair given to the men who have seen service with the company since Mr. Litchfield's advent in 1900.

PROVIDENCE STAGES MOTOR TRUCK PARADE

Elaborately Decorated Vehicles Help Put Over the Ship-by-Truck Idea

PROVIDENCE, Nov. 26—The importance of the ship-by-truck movement was given concrete expression here recently by a parade of several hundred motor trucks through the streets of Providence and Pawtucket.

Almost every possible use of a motor truck, as well as nearly every variety of motor truck, was represented. The parade was indicative not only of the extent to which the motor truck is supplanting the horse drawn vehicle, but also as a demonstration of the possibililies of motor transportation.

While the utilitarian aspect of the motor truck was in the ascendency, variety was given the demonstration by elaborate decorations by some of the participants. Prizes were offered for special displays. The principal ones were: First general prize, Firestone silver cup for the best decorated truck, won by Duttee W. Flint with a Pierce-Arrow truck carrying a Fordson tractor and silo filler, the latter blowing confetti all over the city.

A prize of $100 donated by Duttee W. Flint for the best decorated Ford truck was won by the National Decorating Co. The blue and red Firestone ribbons for dealers having the largest number of trucks in the parade were won by B. F. & A. W. Hopkins, blue, with 29 Reos, and R. E. Arter, red, with 25 Federals.

Perth Amboy Show Spaces Are Taken

PERTH AMBOY, N. Y., Nov. 22—With details of its organization complete, The Perth Amboy Automobile Dealers' Association have arranged an automobile show to be held in the auditorium this city, from March 1 to 6 inclusive. Forty-one makes of passenger cars and 20 equipment booths will comprise the exhibit, space for all of which has been allotted and paid for with the exception of six equipment spaces. Every dealer in the city is a member of the new association and all are active in exhibit plans.

TOPEKA TO HOLD SHOW

TOPEKA, KANSAS, Nov. 24—The Topeka Auto Trades Association will hold an automobile show late in January or early in February in the building at Eleventh Street and Kansas Avenue just being completed by the W. H. Imes Motor Co. Details of the exhibit are as yet incomplete.

Topeka automobile dealers will attend the state convention of the Kansas Auto Trades Association on Dec. 10 in a body, two special Pullmans being arranged to take them to and from Wichita.

DELAWARE GOOD ROAD ASSOCIATION FORMED

Will Promote Public Interest in State Highway—Adopt $3,500,000 Program

WILMINGTON, DEL., Nov. 24—The good roads movement in Delaware received its biggest boost last week when the State Highway Department, now only three years old, conducted a three-day exhibition in the Hotel duPont, concluding Saturday with a convention of the department's engineers, Governor John G. Townsend, Jr., being the host.

At the convention an association was formed known as the Good Roads Association of Delaware. Its object is to promote public interest in good roads. All residents of the state, men and women, are eligible to membership. The following officers were elected: President, Charles M. Upham, chief engineer of the State Highway Department; vice-president, Charles E. Grubb, New Castle county engineer; secretary, W. W. March; treasurer, Harry L. Maier, chief engineer of Wilmington; executive committee, C. N. Connor, W. E. Hawkins, Albert S. Hirzel, C. S. Gale and Dean Cullimore of Delaware College.

During the convention Josiah Marvel of Wilmington, a member of the highway commission, stated that the department had made a traffic survey of 238 miles of road and had let contracts for the construction of 75 miles of highways at a cost of $3,500,000. He also stated that road police system had been started and that the roads will be maintained by patrols.

President Appoints Conference Board

WASHINGTON, Nov. 20—Another industrial conference, which will attempt to settle the problems between capital and labor in this country, will be held here December 1. President Wilson has named the following personnel for the conference:

T. W. Gregory, New York; George W. Wickersham, New York; Oscar S. Straus, New York; Henry N. Robinson, Pasadena, Calif.; Prof. Frank W. Taussig, Cotuit, Mass.; Samuel W. McCall, Boston, Herbert Hoover, Palo Alto, Calif.; Martin H. Glynn, Albany; Henry T. Stuart, of Virginia; Dr. W. D. Thompson of Ohio; Richard Hooker, Springfield, Mass.; George T. Slade, St. Paul, Minn.; Julius Rosenwald, Chicago; Owen D. Young, New York; H. J. Waters, of Kansas; Stanley King, Boston.

SHOW RECORDS FALL

PARIS, Oct. 29—(Special Correspondence). More than half a million persons attended the French automobile show in the Grand Palais, Paris, and of these 438,552 paid admission. The total gate receipts were practically one million francs, or exactly $197,343. The show remained open eleven days, comprising two Sundays. The attendance was so great on the first Sunday that the price of admission was doubled for the following Sunday. This did not prevent 59,135 persons passing through the gates, the income from this source being $23,654.

All records for attendance and gate receipts have been broken, and the big income will allow a substantial refund to be made to exhibitors.

British Makers Plan to Copy Ford

LONDON, Nov. 14—(Special correspondence). Rumor has been rife for some time of an intended attempt to produce a British copy of the Ford car. The prospect seems shaping to a definite course, for next week there is to be a meeting in London of Ford dealers to hear and discuss the scheme. The following appears to be the situation:

During the war a number of factories were set aside under government control to make Ford parts for the several thousands of Ford vehicles in government service. Those concerned with this business propose to continue the output as a combine of associated interests, and to use one of the factories for assembling the chassis, to be sold through former Ford agents.

Old Spanish Trail Nearing Completion

NEW ORLEANS, Nov. 24—Delegates attending the annual convention of the Old Spanish Trail Association in San Antonio, Nov. 14-15 report that more than 60 per cent of the work necessary to complete a hard-surfaced highway the entire length of the "trail," from Jacksonville, Fla., to San Diego, Calif., has been finished. New Orleans was not represented at this convention.

The route of the highway is virtually fixed, with the exception of a short stretch or two in Texas, where decision is yet to be made. The route touches New Orleans after passing through Tallahassee, Pensacola, Mobile, Pascagoula, Biloxi and Gulfport. The next meeting place of the association will be Gulfport, Miss.

OPEN FINANCE OFFICE

DETROIT, Nov. 24—General Motors Acceptance Corp., formed to finance dealers handling General Motors products, will open a fourth office to be located in Detroit, covering a district including Michigan, Ohio, West Virginia and Kentucky. I. G. McCreery, vice-president of the Bank of Detroit, has been named manager with William W. Baldwin, of the National City Bank, of New York, assisting him as manager of credits.

TORONTO WANTS DROME

TORONTO, Nov. 24—According to Mayor Church practically every city in Canada has selected a site and is laying out its civic airdrome with the exception of Toronto. Here the controversy still rages regarding the site. Meanwhile the Leaside and Armor Heights airdromes are daily in use.

MORSE REFUSES TO DIVERT ARMY STOCK

Will Offer Surplus Property to America Before Seeking Foreign Sale

NEW YORK, Nov. 22—The government will offer all surplus property on hand to American purchasers before attempting to market the materials abroad, according to a statement recently credited to Director of Sales Morse, in Washington.

Morse is quoted as saying: "In view of concerted attempts made by certain industries to divert particular surplus stocks of war materials from the domestic to the export market, the Director of Sales takes this opportunity to state briefly the sales policy that controls disposition of surplus supplies for foreign consumption.

"Full and adequate opportunity is afforded the American public to acquire the surplus supply of each and every commodity and material held by the War Department before attempt is made to dispose of any part of the surplus for export purposes. The export market is developed only for those surplus stocks the supply of which exceeds the quantity that the domestic market is capable of consuming, or for which because of the manner of manufacture there is no demand except that existing in foreign markets."

RIM SHORTAGE FEARED

NEW YORK, Nov. 20—The effect of the steel strike is being felt to some extent by the tire manufacturers and distributors through the shortage of steel rims.

Although the larger plants had enough rims on hand when the strike came to tide over for a few weeks, it was feared that a prolonged strike would have a serious effect on sales.

At least one large New York tire distributor has felt the rim shortage, but he has received assurance from the factory that the steel workers are returning and that the rim production will soon reach the figure attained before the men walked out.

For a time several of the rim factories were practically closed down, because of the shortage of material, but the reports now indicate that the majority of these plants are beginning to receive steel now.

MAIL BILL IN

WASHINGTON, Nov. 20—Airplane mail service between New York and San Francisco by way of Chicago, Kansas City, Wichita, Albuquerque, Prescott, Ariz. and Los Angeles, is authorized by a bill introduced in the House of Representatives by Congressman Randall. The Postmaster General is also authorized to designate such additional points between these cities as he may find necessary or advisable.

Men of the Industry

Changes in Personnel and Position

NAMED BOARD HEAD

James S. Alexander, president of the National Bank of Commerce in New York, was elected chairman of the board of directors of the French American Banking Corp., New York, at a meeting of the board Nov. 19.

The French American Banking Corp. was organized last April with a capital of $2,000,000 and a surplus of $500,000, all paid in. The interests behind the corporation represent combined resources of one and a quarter billion dollars. It was organized to promote trade between France and the United States, aiming to place at the disposal of American business men banking facilities in France as advantageous as Frenchmen themselves have.

D. F. Edwards has been named assistant to Jay V. Hall, vice-president in charge of motor car production of the Willys Corp., which will turn out the new light "Six." Edwards for two years was assistant to the president of the General Motors Corp. and one of the members of the executive committee of the Olds Motor Works, at Lansing, and later in charge of the plant of the Gier Pressed Steel Co., Lansing.

F. R. Conroy, formerly connected with the Ingersoll-Rand Co., the Willys-Overland Co., and the Garford Co., has resigned from the Cadillac Tool Co. to join the Wisconsin Parts Co., as superintendent. He succeeds J. L. Armstrong, resigned.

Captain L. Ray Buckendale has resigned his commission and returned to the Timken Detroit Axle Co., as passenger axle engineer, chief engineer of plant No. 3.

Joseph Esserman, purchasing agent for the Motor Car Equipment Co., is now vice-president and purchasing agent of the E. G. Manufacturing Co., Inc., New York.

C. H. Brennan, former purchasing agent for Hupp Motor Car Co., and later Detroit representative of Hale and Kilborn, Philadelphia, has joined the forces of Everitt Bros., body builders.

Edward F. Creager, works manager of the Remy electric plant of the General Motors Corp., Anderson, Ind., has resigned. His place will be temporarily filled by other officials of the Remy plant. Creager, more than a year ago, succeeded F. L. Atwood, who is now attached to the executive staff of the Mid-west Engine Co. of Indianapolis.

F. G. W. Sudrow has resigned as Kansas City, Mo., salesmanager of the Chevrolet Motor Co. and has been succeeded by C. C. Meade, salesmanager at Flint, Mich. C. E. Dawson, manager of the Detroit retail store, will be new manager at Flint. The changes were announced by W. C. Sills, general salesmanager, as effective Nov. 22.

William Carl Chapman, formerly assistant advertising manager of the Packard Motor Car Co., of New York, has been promoted to export advertising manager of the Detroit company.

W. E. Seymour, for six years general superintendent of the Eclipse works of Fairbanks, Morse & Co., at Beloit, Wis., has accepted the position of vice-president and general manager of the A. O. Smith Corp., Milwaukee, one of the largest producers in the United States of pressed steel frames, forged, stamped and other metal automotive parts. The addition of Seymour to the executive staff is part of the Smith Corp.'s plan of enlarging its plant and facilities. New shop additions costing $3,350,000 with equipment, are now under construction, increasing the output nearly three-fold by June 1, 1920. W. C. Heath is promoted from assistant to general superintendent, succeeding Seymour at the Eclipse works.

L. E. Jolls has been named works manager of the Detroit Accessories Corp. and he will have complete charge of production in the expansion program to be inaugurated shortly by the corporation. Jolls during the war was works manager for the Dussenberg Corp., and later mechanical engineer for the Willys Corp., in the development of the new Six. The corporation manufactures the Detroit power-driven tire pump and the Detroit clutch.

Fred A. Cornell has been appointed manager of the Timken Roller Bearing Co., department of sales activities. John W. Spray has been put in charge of the central office of the company in Detroit.

P. A. Petrie, who has been in South America for the Dort Motor Car Co., has been made assistant to J. D. Mansfield, general salesmanager.

A. J. McMillon, who formerly operated a garage in Harrisburg, Pa., and later engaged in the sale of the garage equipment products of the Fairbanks Co., New York, has been made general salesmanager of the automobile and service station, equipment division, of that company, whose business is rapidly expanding.

William M. Farans, formerly with the Emil Grossman Manufacturing Corp., Brooklyn, N. Y., will cover eastern territory outside of New York for the E. G. Manufacturing Co., Inc.

Percival Dodge has been appointed salesmanager of the Denby Motor Truck Co., of Detroit, a position for which he has been groomed for the past five years by Garvin Denby, president of the company. Dodge served an apprenticeship in the shops and was made Michigan salesmanager. Later he was assistant treasurer and assistant salesmanager.

HEARNE SETS RECORD

NEW YORK, Nov. 19—"Eddie" Hearne is claiming a world's record for his 100 mi. performance on the dirt track in Phoenix, Ariz., Nov. 8, when he drove a Chevrolet car the distance in 1 hr. 29 min. 09 sec. The previous record is 1 hr. 31 mi. 30 sec.

As soon as the surveyor's certificate, authentically setting the exact length of the Phoenix course is received the performance will be acted upon by the contest board of the A. A. A.

Roscoe Sarles finished second to Hearne in a Frontenac, with Cliff Durant, (Chevrolet), third and Toland Nicholson, (Hudson), fourth.

H. A. Goodwin, Detroit newspaperman, has joined Bollstrom Motors, Inc., of St. Louis, Mich., as advertising manager. The company will manufacture a four-wheel drive motor truck and expects to be in production in the spring.

F. J. Druar, formerly with the Packard engineering department, has become chief engineer of the Standard Motor Truck Co.

L. C. Rockhill has been appointed salesmanager of the Goodyear Tire & Rubber Co., of Akron, O., a newly created position. Rockhill has been with Goodyear twelve years and has had long experience in the sales department.

John H. Rosen, former manager of the Wilmington branch of the Packard company, has been made general distribution manager for Packard cars and trucks in Philadelphia territory.

George Carlson, traffic expert at the Ford motor plant in Portland, Ore., has been elected by Detroit headquarters to become assistant manager of the Ford assembly plant at Copenhagen, Denmark.

A. W. Tyler has resigned as vice-president and general manager of the C. A. S. Products Co.

W. H. Nash, for many years prominent in the automotive industry in Detroit, will leave the Timken-Detroit Axle Co., Dec. 1, to become a salesmanager for the Beaver Manufacturing Co., gas engine builders in Milwaukee.

John L. Bender, salesmanager of the Anderson Forge & Machine Co., Detroit, has resigned to join the C. A. S. Engineering Co., representing the Pollock Steel Co., in Detroit.

C. M. Wallace, formerly with the Packard organization purchasing department, has been made purchasing agent of the Standard Motor Truck Co.

R. R. Vought, of New York, well known in aviation circles, has joined W. B. Stout in Detroit in the United Aircraft Engineering Assn.

James A. Abeles, former vice-president and general manager of the Motor Car Equipment Co. and recently organizer of an eastern house for the Beckley-Ralston Co., of Chicago, has joined forces with the Boyce-Veeder Corp., who will manufacture and market the new Boyce fire extinguisher.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Toledo Corp. Starts New Tractor Plant

TOLEDO, O., Nov. 18.—Work will start at once on the first unit of factories to be erected in Toledo by the Automotive Corp., builders of tractors. The building will be at Tracy and Oakdale streets and will cost $60,000. Material for 1,000 tractors will begin to arrive in Toledo in December and these will be assembled in the plant soon after it is opened in February.

Offices of the corporation have been opened in the Spitzer building and sales headquarters for the present are at 403 Madison avenue. The company plans to produce 1,000 tractors the first year, and with all its buildings erected plans a 30,000 yearly production.

FIRESTONE BUILDS

AKRON, O., Nov. 24.—Ground has been broken for a mechanical building which is to be the latest addition to the factories of the Firestone Tire & Rubber Co. The building will be three stories and is designed to accommodate the electrical, machine, pipe, carpenter, pattern and tin shops. It will be 325x315, fronting on Main street. Eighty per cent of the wall area will be glass and special attention has been given to ventilation. Cost of construction will approximate $400,000.

GET MICHIGAN CHARTERS

LANSING, MICH., Nov. 24.—The following new corporations have been granted charters in Michigan:

LaGrave Trucking Co., Grand Rapids, $2,000 to buy and sell trucks. Clarence E. Pratt, president.

Mayes Bros. Tool Manufacturing Co., Port Austin, $25,000; manufacturing and dealing in tools. John Mayes, president.

Commerce Motor Car Co., Detroit, permitted to increase its capital stock from $400,000 to $700,000, and the Kol-Ben Wheel Co., to transfer its principal office from Detroit to Cadillac, Mich.

BUILD AT CADILLAC

CADILLAC, MICH., Nov. 24.—The new assembly unit of the Acme Motor Truck Co. will be in operation by Dec. 15, doubling the present floor space and permitting greatly increased production. The foundation for the new factory of the Kol-Ben Wheel Co., of Detroit, has been completed and it is believed operations can be started in the building in 90 days, when the plant will be moved here from Detroit. The Detroit Panel & Veneer Co. also will be moved to this city as soon as the building formerly occupied by the Cadillac Manufacturing Co. can be remodeled.

SEWELL CO. BUYS SITE

DETROIT, Nov. 24.—The Sewell Cushion Wheel Co. has purchased a new factory site of 10 acres. Immediate construction of a new factory is planned which will increase production 200 per cent. With 36 branch houses now in operation, sales of Sewell wheels have shown a large increase.

Begin Work on New Doyle Tire Plant

AKRON, O., Nov. 22—Ground has been broken for the first unit of the Doyle Tire and Rubber Co. factory on the 50 acres of land purchased on the main line of the B. & O., midway between Krumroy and Myersville. It is about eight miles from the center of Akron, and situated on the banks of the Tuscarawas River.

The new concern was recently incorporated with an authorized capital of $300,000 by the members of the family of Judge D. A. Doyle.

His son D. A. Doyle, Jr., is president. The latter stated that the company has set aside 10 acres for industrial purposes, and the balance will be laid out in building lots. The company will begin the erection of dwellings in the spring at which time the first factory building 54x 110 feet, will be ready for occupancy.

The company has donated a plot of ground along the tracks of the B. & O. for a station and the railroad has agreed to build one and make it a regular stop. A meeting of the residents in the vicinity will be held in a few days to decide on a name to be given the station and proposed settlement. They expect to begin operation with 100 employes, and while it is their intention to manufacture a general line of rubber goods, they will begin with the manufacture of tires.

ALUMINUM REORGANIZES

CLEVELAND, Nov. 21.—The Aluminum Castings Co. has been reorganized under the name of Aluminum Manufacturers, Inc., with additional capital required for development. Besides taking over the existing plant, the new company plans to erect an aluminum forging plant and other plants for making finished aluminum products. Management of the new company will be the same as formerly.

NEW BELOIT FOUNDRY

BELOIT, WIS., Nov. 24—Fairbanks, Morse & Co., Chicago, announce that work will begin immediately after Jan. 1 on a new gray iron foundry for the Eclipse works at Beloit, Wis., which will have a capacity of 400 to 450 tons a day and cost $1,500,000. It will be one of the largest gray iron shops in the Middle West and when manned will increase the payroll at the Beloit works nearly 7,000 men. The new foundry will have eight cupolas and contain 496,000 sq. ft. of floor space.

Koehler Corp. to Build New Plant

NEWARK, N. J., Nov. 26—Work on the first unit of what is announced to be the forerunner of a million dollar plant has been started for the H. J. Koehler Motors Corp., in Bloomfield. The first building will be 100x260, one story in height, and will be ready for occupancy by Feb. 1. When completed the company will discontinue its present plant at 154 Ogden Street, Newark.

The company plans the construction of a new truck in 1¼ and 2½-ton sizes and will discontinue manufacturing its present type of trucks of this size. In addition the company plans making a 5-ton road tractor. With complete modern equipment the company is planning a production of six trucks a day.

FIVE COMPANIES FORMED

WILMINGTON, DEL., Nov. 24—The following corporations have been chartered under the laws of Delaware:

Murray Motor Car Co., with a capital of $2,000,000, to manufacture automobiles. The incorporators are M. L Rogers, L. A. Irwin and M. M. Nichols, all of Wilmington.

Chain and Sprockett Service Co. of Cleveland, O., with a capital of $110,000, to manufacture machinery and tools of all kinds. The incorporators are R. H. Sadler, E. W. Penter and L. B. Davenport, all of Cleveland.

King Leather Tire Co., with a capital of $1,000,000, to manufacture automobile tires and other accessories. The incorporators are M. L. Rogers, L. A. Irwin and W. G. Singer, all of Wilmington.

Elastic Auto Body Co. of Wilmington, with a capital of $500,000, to manufacture automobile bodies, etc. The incorporators are M. L. Horty, M. C. Kelly and S. L. Mackey, all of Wilmington.

Solid Inner Tube Co. of Wilmington, with a capital of $50,000, to manufacture tubes, tires, etc. The incorporators are T. L. Croteau, P. B. Drew and H. E. Knox, all of Wilmington.

LOCATE IN ELKHART

SOUTH BEND, IND., Nov. 24.—The Landover Auto Truck Co., formerly of Marinette, Wis., has located its plant in Elkhart, Ind. The company will employ 200 people in the near future and will specialize in the production of a five-ton truck embodying a new patented idea. The officers of the company are: J. W. Shaw, president, and N. H. Boardman, secretary and treasurer, formerly of Bradstreet & Co. The chief engineer is E. F. Paepper, who for four years was with the Mercer Automobile Co., and during the war was chief engineer of the Republic Motor Truck Co., of Alma, Mich.

WILMINGTON SHOW SET

WILMINGTON, DEL., Nov. 24—Wilmington will have a motor show in January immediately following the Philadelphia show. It will be held in the new ballroom of the Hotel duPont.

Calendar

SHOWS

January—New York. International Automobile Mfrs.' Congress.

Jan. 3-10—New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce. S. A. Miles, Manager.

Jan. 3-10—New York City. Eighth Coast Artillery Armory, commercial cars and accessories.

Jan. 8—Chicago. Airplanes. Manufacturers' Aircraft Association. Congress Hotel.

Jan. 17-21—Cleveland. Nineteenth Annual Automobile Show, Cleveland Automobile Mfrs.' and Dealers' Assn., Wigmore Coliseum.

Jan. 17-24—Hartford, Conn., Shows, State Armory. Manager Annual Exhibition. Arthur Fifoot.

Jan. 19-25—Milwaukee, Wis., Auditorium, Annual Motor Exhibition. Milwaukee Automobile Dealers' Inc.

Jan. 24-31—Chicago, Ill. Coliseum. Cars: Drexel Pavilion. National Automobile Chamber of Commerce. S. A. Miles, Manager.

Jan. 24-31—Chicago. International Amphitheater, commercial cars and accessories.

Jan. 31-Feb. 6 — Kansas City, Mo. Annual exhibition, Overland Bldg. E. E. Peake, Manager.

Feb. 2-7—Toledo, Ohio. Annual Automobile Show, Terminal Auditorium.

Feb. 9-14—Nashville, Tenn. Nashville Automobile Trade Association.

Feb. 21-28—Ottawa, Ont. Motor Show.

Feb. 23-28—Louisville, Ky. Twelfth annual exhibition, Louisville Automobile Dealers' Assn., First Regiment Armory.

February—Chicago. International Automobile Mfrs" Congress.

February—Deadwood, S. D. Annual Show, Deadwood Business Club. F. R. Baldwin, Manager.

March 13-20—Boston, Mass. Annual Automobile Show. Mechanics' Building.

FOREIGN SHOWS

December—Brussels, International Automobile Mfrs.' Congress.

Dec. 1-9Jan. 4—International Aviation Exhibition, Paris, France.

January—Glasgow, Scotland Scottish Motor Exhibition.

February — Manchester, England. North of England Motor Exhibition.

Feb. 22-March 6 — Birmingham, Eng. British Industries Fair.

March—London, Eng. Motor Boat Marine and Stationary Engine Exhibition.

March—Adelaide, Australia. All Australian Exhibition of motor vehicles, airplanes, engines and automotive equipment.

March 1-15—Lyons, France. Automotive Products. Lyons Industrial Fair.

April or May—London, Eng. Commercial Vehicles Exhibition, Olympia.

April 3-May 4—Buenos Aires. Exposition of U. S. manufactures.

TRACTOR SHOWS

Feb. 9-14—Kansas City, Mo. Fifth Annual Kansas City Tractor Club. Guy H. Hall, Manager.

Feb. 9-14—Wichita, Kan. Tractor and Farm Machinery, Forum, Wichita Thresher-Tractor Club.

CONTESTS

Dec. 29—Los Angeles, Cal. Ascot Speedway race.

June, 1920—Omaha, Nebr. Reliability Truck Tour.

August, 1920 — Paris, France. Grand Prix Race, Sporting Commission. Automobile Club of France.

CONVENTIONS

Dec. 3-5—Cleveland, Ohio Automobile Trade Assn. annual convention.
American conference.

Feb. 9-13—Louisville, Ky. Seventeenth Annual Convention American Road Builders' Assn., Tenth American Good Roads Congress and Eleventh National Good Roads Show.

May 15-20, 1920—San Francisco. Seventh National Foreign Trade Convention.

Transport Corps Reports Big Sales

WASHINGTON, Nov. 25—Reports received at the Motor Transport Corps Headquarters indicate that 2,065 vehicles were sold throughout the country to Nov. 14, for a total of $681,840, an average of $330 a vehicle. A large number of motorcycles were included in this total.

One of the largest sales of unserviceable army motor vehicles yet held is announced for Camp Holabird, Md., Monday and Tuesday, Dec. 1-2. Among the vehicles to be put on the block are: Passenger cars, Dodge (2), Ford (2), Cadillac (1); Trucks, Mack (53), Packard (167), Pierce-Arrow (18), and Light Aviation trucks (19).

Sales are scheduled for Camp Grant, Ill., Dec. 2 and Langley Field, Hampton, Va., Dec. 3.

Will Build Engine with Sixteen Parts

ALBANY, N. Y., Nov. 20—The Twin Energy Motors Co. has been incorporated at the office of Secretary of State Hugo with a capital stock of $1,000,000 to manufacture a twin-energy engine, a new type, which tests are claimed show will develop large mileage on a gallon of fuel. The inventor is William H. Schneider of Albany, an automotive engineer formerly with the Ford company.

A novel feature of the engine is that it comprises only 16 moving parts, as against more than one hundred in other engines. The inventor has declined to divulge the exact increase in operation efficiency the engine has shown under tests but it is asserted the efficiency is almost doubled. It will be manufactured as automobile, stationary, aircraft, tractor, truck and marine engines.

The engine was perfected after experiments by Schneider covering a period of seven years. During the war he was drafted into service of the radio laboratories. Plans are now being prepared for a plant with floor area of five acres to be erected on a site around Albany.

Purchase Site for Middletown Cords

NEW YORK, Nov. 24—Organization by Chicago and Cleveland tire men of the Middletown Rubber Co., Inc., has been completed, and the company has secured a site at Middletown, N. Y., where it will erect a plant for the manufacture of "Middletown Cord" casings, inner tubes and other rubber products. The company is announced as a million dollar concern.

The plant will be located on the main line of the Erie railroad and will have water power and ample labor. It is expected to produce 1,000 cord tires a day. Myron J. Friedman, Chicago, is president of the company, other officers being William Rusnak, Chicago, vice-president; J. T. MacDonald, Cleveland, treasurer and general manager, S. A. Thompson, Cleveland, secretary, and T. W. Decker, Cleveland, director. All are tire men of national reputation.

A. A. A. Sanctions Omaha Truck Tour

NEW YORK, Nov. 19—The 2,500 mile reliability truck tour, starting and ending in Omaha, Neb., which is being sponsored by the Omaha News Bee, has received the sanction of the Contest Committee of the A. A. A.

The present arrangements contemplate starting the tour in June, 1920. It is proposed to limit competition to one-half to three and one half ton vehicles, equipped with pneumatic tires and loaded to capacity with sand. The full capacity load is not to include weight of the driver and spare parts.

NAPOLEON CO. REBUILDS

DETROIT, Nov. 24.—Napoleon Motors Co., Traverse City, Mich., is completing plans for expansion of business, with construction of buildings to replace those burned recently. The company will cease manufacturing passenger cars and will devote its future activities to production of the Napoleon truck.